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DVV 1.1.3: **Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution during 2019-20**

Content	PROGRAMME	Page No
Syllabus copy of the courses highlighting the focus on employability/ entrepreneurship/ skill development.		
Year 1 (2019-2020)	Chemical Engineering	**1 - 129**
	Civil Engineering	**130 - 263**
	Computer Science Engineering	**264 -389**
	Information Technology	**390 - 507**
	Electronics and Communication Engineering	**508 - 615**
	Electrical and Electronics Engineering	**616 - 714**
	Mechanical Engineering	**715 - 875**
	M.Tech (Control Systems)	**876 - 894**
	M.Tech (Bio-Technology)	**895 - 937**
	M.Tech (Soil Mechanics)	**938 - 973**
	M.Tech (Machine Design)	**974 - 1018**
	M.Tech (Communication Systems)	**1019 - 1054**
	M.Tech (Computer Science & Technology)	**1055 - 1081**

ENGINERING DRAWING

(Common for all branches)

Course Objectives:

- The course is designed to introduce fundamentals of engineering drawing and apply the

Course Code - Category: CHE 115 - ES **Credits:3.5**

L	**T**	**P**	**E**	**O**	
2	**0**	**3**	**1**	**4**	Sessional Marks:40

End Exam: 3 Hours End Exam Marks:60

principles to draw engineering curves, orthographic projections and isometric projections.

Course Outcomes:

By the end of the course, the student will be able to:	
CO 1	Draw conic sections by different methods and construct cycloidal and involute curves.
CO 2	Project orthographically the points and lines in various positions.
CO 3	Produce orthographic projections of plane surfaces
CO 4	Draw orthographic projections of solids in various orientations.
CO 5	Construct isometric views and isometric projections of simple solids.

SYLLABUS

UNIT I

Introduction to Engineering drawing & basics of geometrical construction. General Construction of conic sections, Ellipse - concentric circle and arcs of circle method, Parabola- rectangle and tangential method Hyperbola - Rectangle hyperbola, Construction of cycloidal curves (cycloid, epicycloid, and hypocycloid), Involute(thread length equal to circumference/ perimeter) - circle and regular polygon.

UNIT II

Orthographic projections – projections of points – projections of straight lines (lines parallel to both HP&VP, lines parallel to one and inclined to other, lines inclined to both the planes)

UNIT III

Projections of regular polygon planes – inclined to one plane, inclined to both the planes.

UNIT IV

Projection of solids: Prisms – Cylinder– Pyramids &Cones –simple positions & axis inclined to one plane, inclined to both the planes.

UNIT V

Isometric projections –Isometric scale, Isometric view & projection of prisms, pyramids, cone, cylinder, sphere, and their combination.

TEXT BOOK:

1. **N. D. Bhatt** "*Engineering Drawing"* Charotar Publishing House Pvt.Ltd, 53rd Edition : 2014

REFERENCE BOOKS:

1. **K. L. Narayana& P. Kanniah** "*Engineering Drawing"*
2. **R. B. Choudary** "*Engineering Graphics* with Auto CAD"
3. **TrymbakaMurty** "*Computer Aided Engineering Drawing"*

ENGINEERING WORKSHOP

Common for all branches except for ECE

Course Code - Category: CHE 118 - ES **Credits:1.5**

L	**T**	**P**	**E**	**O**	
0	**0**	**3**	**0**	**1**	Sessional Marks:50

End Exam: 3 Hours End Exam Marks:50

Course Objectives:

- To provide training and hands on experience to the students on basic Engineering related skills like carpentry, fitting, tin smithy, house wiring and soldering.

Course Outcomes:

By the end of the course, student will be able to:	
CO1	Make different carpentry joints.
CO2	Make simple fitting jobs.
CO3	Make simple jobs like funnel, elbow etc. using sheet metal.
CO4	Understand and build circuits for different types of applications like stair case wiring, godown wiring.
CO5	Make simple circuits on bread board using soldering kit

LIST OF EXPERIMENTS

Minimum of two exercises has to be conducted from each trade.

Trade:

Carpentry	1. Cross Lap Joint
	2. Dovetail Joint
	3. Mortise and Tennon Joint
	4. Briddle Joint
Fitting	1. V Fit
	2. Square Fit
	3. Half Round Fit
	4. Dovetail Fit
Tin Smithy	1. Taper Tray
	2. Square Box without lid
	3. Elbow
	4. Funnel
House Wiring	1. Parallel / Series Connection of three bulbs
	2. Stair Case wiring
	3. Godown wiring
Soldering	1.LED bulb
	2. Dc motor with pot
	3. De soldering PCB

Reference book:

1. **S.K.Hajra Choudhury** “*Elements of Workshop Technology” Vol I Manufacturing Processes,* ISBN: 8185099146(2017)

COMMUNICATIVE ENGLISH

Common for all branches

Course Code - Category: CHE 122- HS **Credits:3**

L	T	P	E	O
3	0	0	1	4

Sessional Marks:40

End Exam: 3 Hours

End Exam Marks:60

Prerequisites:
Basic English language skills- LSRW at (10+2) / Intermediate Level

Course Objectives

- To focus on appropriate reading strategies for comprehension of various forms of texts.
- To instruct effectives strategies for good writing and exhibit the same in writing well organized passages, reports and other forms of business communication
- Provide knowledge of grammatical structures and vocabulary to be used appropriately in their writing.

Course Outcomes

By the end of the course, the student will be able to:	
CO1	Comprehend, interpret and analyze text and answer questions based on passages.
CO2	Demonstrate good writing skills for effective paraphrasing, argumentative essays and formal correspondence.
CO3	Construct grammatically correct sentences and apply proper vocabulary in speech and writing.

UNIT- I **10 Periods**

Reading: **1.**Skimming and Scanning to get the main idea of a text and look for specific information**-**On the Conduct of Life: *William Hazlitt* 2. If- *Rudyard Kipling* –**CO1**
Writing: Paragraph writing (specific topics) using suitable cohesive devices – Unity, logical order, coherence, opening and closing statements. **CO2**
Grammar: Clauses and Sentences: Sentence structures, use of phrases and clauses in sentences **CO3**
Vocabulary: The concept of word formation, Acquaintance with prefixes and suffixes **CO3**

UNIT –II **10 Periods**

Reading: **1.** Reading for inferential comprehension- The Brook: *Alfred Tennyson* 2. How I Became a Public Speaker: *George Bernard Shaw* **CO1**
Writing: Formal letter writing. Letters of complaint, enquiry, report, invite, placing orders, acknowledgment and follow-up letters. **CO2**
Grammar: Punctuation: importance of proper punctuation in texts, Articles **CO3**
Vocabulary: Word building using foreign roots **CO3**

UNIT – III **10 Periods**

Reading: 1. Comprehend complex texts identifying the author's purpose-

The Death Trap: *Saki* 2. On Saving Time: *Seneca* **CO1**

Writing :: Reports (Structure and content of a project report) **CO2**
Grammar : Noun-Pronoun Agreement, Subject –Verb agreement, Tenses **CO3**
Vocabulary: Idiomatic expressions **CO3**

UNIT –IV **10 Periods**

Reading: 1. Identifying claims, evidences, views, opinions and stance/position.**-**
Chindu Yellama 2. Muhammad Yunus **CO1**
Writing Skills: 1.Writing structured essays (persuasive and argumentative) using suitable claims and evidences CO2
Grammar: Misplaced Modifiers, adjectives, adverbs **CO3**
Vocabulary: Synonyms & Antonyms **CO3**

UNIT –V **12 Periods**

Reading: Developing advanced reading skills for deeper understanding of the text
Politics and the English Language: *George Orwell* 2.The Dancer with a
White Parasol: *Ranjana Dave* **CO1**
Writing : Précis writing (Summarizing-identifying main idea and rephrasing the text), Applying for internship/Writing job applications: Resume and C.V with cover letter **CO2**
Grammar: Prepositions, correction of sentences. **CO3**
Vocabulary: Phrasal verbs **CO3**

Prescribed book:
Board of Editors "*Language and Life*" 1st edition, Oriental Black Swan 2018.

Reference Books:
1. **Sanjay Kumar and Pushpa lata** *"Communication skills*" Oxford University Press. 2011

2. **Meenakshi Raman and Sangeetha Sharma "***Technical communication*" Oxford University Press.

3. **Kulbushan Kumar "***Effective communication skills*" Khanna Publishing House, Delhi.

PHYSICAL AND ANALYTICAL CHEMISTRY

(For Chemical Engineering)

Course Code - Category: CHE 123 - BS **Credits:3**

L	**T**	**P**	**E**	**O**	
3	**0**	**0**	**1**	**5**	Sessional Marks:40

End Exam: 3 Hours End Exam Marks:60

Course Objectives

- To understand the concept of Homogenous and heterogeneous chemical equilibriumwith its importance in industrial process.
- To get an idea about the Surface chemistry and its characterization.
- To give a knowledge on basic quantitative techniques of Titrimetry and Gravimetry.
- To inculcate the concept of various Electro-analytical techniques.
- To give an awareness on various Separation techniques.

Course Outcomes

By the end of the semester, the student will be able to:	
CO1	**Apply** the Homgeneous and heterogeneous Chemical equilibria laws in various systems and **Develop** Optimum conditions for these systems in Industrial Processes
CO2	**Familarize**in the concepts of surface characterisation by using X-Ray difraction and stabilization of colloids and nanomaterials.
CO3	Get **Knowledge** on the Quantitative determination of various samples either by using Titrimetry or gravimetry with least error.
CO4	Get adept in **Computing** pH, Potential and conductance by electro analytical methods
CO5	Separate impurities by **Applying** Solvent extraction and Gas chromotagraphy Techniques

SYLLABUS

UNIT-1 **12 periods**

Chemical Equilibrium: Reversible and irreversible reactions, concept of equilibrium, Law of Mass action, Equilibrium constant, Factors influencing equilibrium constant, apply law of mass action tohomogeneous gaseous and liquid systems, Le-Chatelier principle- applications, Effect of temperature on equilibrium constant -derivation

Phase rule: Definition-explanation of terms-Derivation of Phase Rule-One component system (water system)-Two component system (Ag-Pb), Eutectic mixture-its significance.

Learning Outcomes:

At the end of the unit the student will be able to

- **list** the differences between Reversible and Irreversible reactions (L1)
- **Apply** the law of Mass action to different homogeneous and heterogeneous systems (L2)
- **State** Le- chatlier principle(L1)
- **Develop** Optimum conditions for few Industrial process reactions(L5)

UNIT-II **10 periods**

Surface Chemistry: Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelle formation, method of preparation of nanomaterialsby Chemical Vapour deposition methods, stabilization of colloids and nanomaterials by stabilizing agents.

Characterization of surfaces - X-ray diffraction-Principle & Instrumentation; Adsorption-B.E.T equation (no derivation), Surface area-importance and Determination by B.E.T method, Applications of colloids and nanomaterials.

Learning Outcomes:

At the end of the unit the student will be able to

- **Illustrate** the role of an stabilizing agents in stabilization of colloids and nano material (L2)
- **Explain** the principles and instrumentation of X – Ray Diffrection (L2)
- **Apply** BET equation in measuring surface area(L3)

UNIT-III **10 periods**

Introduction to Chemical analysis –Quantitative analysis, classification of errors-accuracy, precission-minimization of errors; Titrimetric Analysis, Classification of reactions in titrimetric analysis-Standard solutions- Primary and Secondary standards, Theory of Indicators(Acid Base, Redox, Complexometric & precipitation Titrations); Gravimetric analysis-process of precipitation, contamination of precipitates (co-precipitation & post precipitaion)

Learning Outcomes:

At the end of the unit the student will be able to

- **Describe** different ways of minimization of errors(L2)
- **Explain** the theories behind different types of indicators (L2)
- **Analyse** the amount of Nickel present in the given sample(L4)

UNIT-IV **10periods**

Electro-analytical Methods: Potentiometry-introduction, instrumentation and potentiometric titration (Redox); introduction to pH, determination of pH, pH metric titrations. Conductometry- conductance and types of conductance, Conductmetric Titrations (Acid-base)**,** variation of conductance with temperature, Kohlrausch’s law and applications- calculation of equivalent conductance and degree of dissociation of weak electrolytes.

Learning Outcomes:

At the end of the unit the student will be able to

- **Define** electrode potential (L1)
- **Explain** the Instrumentation of Potentiometry(L2)
- **Compute** the strength of Acids and basesby pH meter (L3)
- **Apply** the Kohlrausch's law in measurement of equivalent conductance of weak electrolytes (L4)

UNIT-V **10 periods**

Basics of Industrial SeparationTechniques:

Distribution law-partition coefficient, Solvent extraction-multiple extractions; Chromotography-principle, RF value, resolution and retention time, types of chromotogaphy-Thin layer and gas chromotography-instrumentation.

Learning Outcomes:

At the end of ths unit the student will be able to

- **State** Distribution Law (L1)
- **Explain** the efficiency of multiple extractions (L2)
- **Separate** impurities from an analyte using Gas chromatography (L4)

Prescribed text books

1. **Arun Bhal, B.S.Bhal and G.D.Thuli** “*Essentials of Physical chemistry*” S.Chand and company ltd. 2009.
2. **Chatwal and Anand**; “*Instrumental Methods of Chemical Analysis*” 5^{th} edition, Himalaya Publishing Company.

Reference books

1. **Peter Atkins & Julio de Paula** "*Physical Chemistry*" 7th edition, oxford university
2. **B.R.Puri and L.R.Sharma** "*Principles of Physical Chemistry"*, 44th edition press vishal publishing company, New Delhi.
3. **Vogel** "*Text book of Quantitative Chemical Analysis"* 6th edition, Pearson, 2014.

Problem Solving With C
(Common to all branches)

Course Code - Category : CHE 125 - ES **Credits: 3**

L	T	P	E	O
3	0	0	1	6

Sessional Marks:40

End Exam: 3 Hours End Exam Marks:60

Prerequisite: No specific prerequisites are needed

Course Objectives:

- This course aims to provide exposure to problem-solving through programming in C. It aims to train the student, the concepts of C-Programming Language. This course involves a lab component which is designed to give the student hands-on experience with the concepts.

Course Outcomes:

After completion of this course, a student will be able to:	
CO1	Gain knowledge in problem solving and steps in Program development.
CO2	Apply the basic concepts of C
CO3	Implement different operations on arrays and string to solve any given problem.
CO4	Demonstrate pointers and modularization
CO5	Apply structures and unions and Implement file Operations in C programming for any given application

SYLLABUS

UNIT I 10 Periods

Introduction to Computer Problem-solving : Introduction ,The Problem-solving Aspect, Top-Down Design, Implementation of Algorithms, Program Verification **(Text Book 3 Page 1-29 or Reference material 1)**
Computer Science as a Career Path : Why Computer Science May be the Right Field for You, The College Experience: Computer Disciplines and Majors to Choose From Career Opportunities.
Electronic Computers Then and Now, Computer Hardware, Computer Software, The Software Development Method, Applying the Software Development Method, Professional Ethics for Computer Programmers. **(Text Book 2 Page 1-39)**
Computer Languages, Writing Editing compiling and linking programs, Program Execution, System Development, Flowcharting, Introduction to C Language – Background, C Programs, Identifiers, Types, Variables, Constants, Coding Constants, Formatted Input / Output. **(Text Book 1)**

Learning Outcomes : At the end of this Unit the student will be able

- To gain knowledge in the concepts of problem solving
- Identify the steps in Program development
- Learn number system.

UNIT II 10 Periods

Number systems-Binary, Decimal, Hexadecimal and Transformations, storing integers and floats. Program – expressions, precedence and Associativity, Side effects, evaluating expressions, mixed type expressions, statements.

Selection –Making Decisions – Logical data and operators, Bitwise Operators- logical bitwise operators, shift operators, bitwise use, Two way selection, Multi way selection

Repetition – concept of a loop, pretest and posttest loops, initialization and updating, event controlled and counter controlled loops, loops in C, loop examples, other statements related to looping, looping applications **(Text Book 1)**

Learning Outcomes : At the end of this Unit the student will be able to

- Apply decision making in c programming for problem solving
- Apply controlled structures in c programming for problem solving

UNIT III **10 Periods**

Arrays – Concepts, using arrays in C, array applications, linear search, and Bubble sort, two – dimensional arrays, multidimensional arrays .

Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions **(Text Book 1)**

Learning Outcomes : At the end of this Unit the student will be able to

- Implement different operations on arrays
- Use string functions
- Apply string manipulation operations for problem solving.

UNIT IV **10 Periods**

Functions-Designing Structured Programs, Functions in C, user defined functions, standard library functions, scope, Recursion

Storage classes-auto, register, static, extern

Pointers – Pointer Applications – Arrays and Pointers, pointer arithmetic and arrays, passing an array to a function, understanding complex declarations, memory allocation functions, array of pointers, programming application selection sort. **(Text Book 1)**

Learning Outcome : At the end of this Unit the student will be able to

- Know what a pointer is
- How to modularize a program
- Parameter passing techniques
- Write a recursive functions

UNIT V **10 Periods**

Derived Types Enumerated, Structure and Union Types – The Type Definition (typedef), Enumerated types, Structures, accessing structures, Complex structures, arrays of structures, structures and functions ,unions

Text Files – Concept of a file, files and streams, input / output functions, formatting input/output functions, character input/output functions, character input/output examples

Binary files – classification of files, using binary files, standard library functions for files, converting file type, file program examples. **(Text Book 1)**

Learning Outcome : At the end of this Unit the student will be able to

- Write a structure and union
- Create and manage a file
- Use structure and union in files

Text Books:

(1) **B. A. Forouzan and R. F. Gilberg** "*Cengage Learning , Computer Science: A Structured Programming Approach Using C*" Third Edition.
(2) **Jeri R. Hanly , Elliot B .Koffman** , "*Problem solving and program Design in C*" , 7th Edition
(3) **R.G.Dromey** , "*How to solve it by computer, Prentice-Hall International Series in Computer Science*" C.A.R. Hoare Series Editor

Reference Books:

(1) *"An Introduction to Computer Science and problem solving*" - IT Department Material
(2) **"Dietal & Deital**" , "*C How to Program 7/E"* ,PHI Publications
(3) **Yashavant Kanetkar** , "*Let Us C"*, 16th Edition
(4) **Brian W. Kernighan and Dennis M.Ritchie**, "*The C Programming Language"*, Prentice Hall of India

English Language lab

Course Code - Category: CHE 126 – HS **Credits:1.5**

L	T	P	E	O
0	0	3	0	1

Sessional Marks:50

End Exam: 3 Hours

End Exam Marks:50

Prerequisites:
Basic English language skills- LSRW at Intermediate Level

Course Objectives

1. To improve fluency in spoken English and to practice correct pronunciation.
2. To introduce the techniques of presentation skills
3. Help improve speaking skills through participation in activities such as role plays, discussions, and structured talks/ oral presentations

Course Outcomes

By the end of the course, the student will be able to:	
CO1	Speak English with proper pronunciation and intonation
CO2	Make effective oral presentations by interpreting and analysing data, pictures and videos and participate in Group Discussion on general topics
CO3	Make meaningful conversations and follow logical flow of thought; answer questions on key concepts after listening to extended passages.

Syllabus

Module- I

The sounds of English CO1

1. Practicing correct Pronunciation through IPA, Stress, Intonation, Rhythm

Module –II

Group Discussions CO2

1. Purpose, Different roles for participants, Etiquette in a structured GD - Practice GDs

Module –III

Interpersonal Skills CO3 (Role plays)

1. Introduction of self and others, making announcements
2. Getting Someone's Attention, and Interrupting Conversations
3. Making Requests and Responding to them, asking for directions

Module –IV

Listening Skills CO3

1. Listening to unknown passages – for global understanding, identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Module –V

Presentation skills CO2

1. Oral Presentations (JAMs) 2. Describing and analysing videos and pictures.3. Interpreting and analysing data from graphs and charts

Prescribed book:
Oriental Black Swan. "*Language and Life*" 1st edition, 2018 Board of Editors. .

Reference Books:
1. **J.K. Gangal.** "*A Practical Course in Effective English Speaking Skills"*. Prentice Hall India Learning Private Limited 2012.

Problem Solving with 'C'Lab

(Common to all branches)

Course Code - Category: CHE 127 - ES **Credits:1.5**

L	T	P	E	O
0	0	3	0	3

Sessional Marks:50

End Exam: 3 Hours

End Exam Marks:50

Prerequisite: Concepts of Problem Solving & Computer Programming in C

Course Objective:

- The course aims at translating given algorithms to a working and valid program

Course Outcomes:

After completion of this course, a student will be able to:	
CO1	Develop C programs using operators
CO2	Write C programs using conditional structures
CO3	Write C programs using iterative structure arrays and strings
CO4	Inscribe C programs that use Pointers toand functions
CO5	Develop a c program for implementing user defined types and file processing

SYLLABUS

MINIMUM SET OF SAMPLE PROGRAMS

1. CONVERTING MILES TO KILOMETERS

PROBLEMSTATEMENT: Your summer surveying job requires you to study some maps that give distances in kilometers and some that use miles. You and your coworkers prefer to deal in metricmeasurements. Write a program that performs the necessary conversion.

Problem Input: miles /* the distance in miles*/
Problem Output: kms /* the distance in kilometers */
Relevant Formula: *1 mile = 1.609 kilometers*

Design algorithm , flow chart ,program using the above data requirements for the given problem.
Try the sample test cases given below :

SAMPLE TEST CASES	INPUT	OUPUT
Test case 1	10	16.09
Test case 2	2	3.218

2. SUPERMARKET COIN PROCESSOR

PROBLEM STATEMENT : You are drafting software for the machines placed at the front of supermarkets to convert change to personalized credit slips. In this draft, the user will manuallyenter the number of each kind of coin in the collection, but in the final version,these counts will be provided by code that interfaces with the counting devices inthe machine.

Problem Inputs
char first, middle, last /* a customer's initials */
int dollars /* number of dollars */
int quarters /* number of quarters */
int dimes /* number of dimes */
int nickels /* number of nickels */
int pennies /* number of pennies */
Problem Outputs
inttotal_dollars /* total dollar value */
int change /* leftover change */
Additional Program Variables
inttotal_cents /* total value in cents */

Design algorithm, flow chart ,program using the above data requirements for the given problem Try the sample test cases given below :

TESTING TIP :

To test this program, try running it with a combination of coins that yield an exactdollar amount with no leftover change. For example, 1 dollar, 8 quarters, 0 dimes,35 nickels, and 25 pennies should yield a value of 5 dollars and 0 cents. Thenincrease and decrease the quantity of pennies by 1 (26 and 24 pennies) to make surethat these cases are also handled properly.

SAMPLE TEST CASES	**INPUT**	**OUPUT**
Test case 1	Type in your 3 initials and press return> JRH JRH, please enter your coin information. Number of $ coins > 2 Number of quarters> 14 Number of dimes > 12 Number of nickels > 25 Number of pennies > 131	JRH Coin Credit Dollars: 9 Change: 26 cents
Test case 2	Type in your 3 initials and press return> JRH JRH, please enter your coin information. Number of $ coins > 3 Number of quarters> 12 Number of dimes > 14 Number of nickels > 50 Number of pennies > 175	JRH Coin Credit Dollars: 11 Change: 26 cents

3.WATER BILL PROBLEM

PROBLEM STATEMENT : Write a program that computes a customer’s water bill. The bill includes a $35 water demand charge plus a consumption (use) charge of $1.10 for every thousand gallonsused. Consumption is figured from meter readings (in thousands of gallons) takenrecently and at the end of the previous quarter. If the customer’s unpaid balance isgreater than zero, a $2 late charge is assessed as well.

Problem Constants
DEMAND_CHG 35.00 /* basic water demand charge */
PER_1000_CHG 1.10 /* charge per thousand gallons used */
LATE_CHG 2.00 /* surcharge on an unpaid balance */
Problem Inputs
int previous /* meter reading from previous quarter in thousands of gallons */

int current   /* meter reading from current quarter   */
double unpaid /* unpaid balance of previous bill   */

Problem Outputs

double bill   /* water bill   */
doubleuse_charge /* charge for actual water use   */
doublelate_charge /* charge for nonpayment of part   of previous balance   */

Relevant Formulas

water bill =   demand charge + use charge + unpaid balance+ applicable late charge

Design algorithm , flow chart ,program using the above data requirements for the given problem Try the sample test cases given below :

SAMPLE TEST CASES	**INPUT**	**OUPUT**
Test case 1	This program figures a water bill based on the demand charge ($35.00) and a $1.10 per 1000 gallons use charge. A $2.00 surcharge is added to accounts with an unpaid balance. Enter unpaid balance, previous and current meter readings on separate lines after the prompts. Press <return> or <enter> after typing each number. Enter unpaid balance> $71.50 Enter previous meter reading> 4198 Enter current meter reading> 4238	Bill includes $2.00 late charge on unpaid balance of $71.50 Total due = $152.50
Test case 2	This program figures a water bill based on the demand charge ($35.00) and a $1.10 per 1000 gallons use charge. A $2.00 surcharge is added to accounts with an unpaid balance. Enter unpaid balance, previous and current meter readings on separate lines after the prompts. Press <return> or <enter> after typing each number. Enter unpaid balance> $51 Enter previous meter reading> 4198 Enter current meter reading> 4137	Bill includes $2.00 late charge on unpaid balance of $71.50 Total due = $102.00

4. PRIME NUMBER

PROBLEM STATEMENT : Given a positive integer **N**, calculate the sum of all prime numbers between **1** and**N**(inclusive).

Input:

The first line of input contains an integer **T** denoting the number of test cases. T testcases follow. Each testcase contains one line of input containing **N**.

Output:

For each testcase, in a new line, print the sum of all prime numbers between 1 and N.

Constraints:
$1 \leq T \leq 100$
$1 \leq N \leq 10^6$

Design algorithm , flow chart ,program using the above data requirements for the given problem Try the sample test cases given below :

SAMPLE TEST CASES	INPUT	OUPUT
Test case 1	2 5 10	10 17
Test case 2	2 7 10	17 17

5. BUBBLE SORT

PROBLEM STATEMENT : The task is to complete bubble function which is used to implement Bubble Sort
Input:
First line of the input denotes the number of test cases 'T'. First line of the test case is the size of array and second line consists of array elements.

Output:
Sorted array in increasing order is displayed to the user.

Constraints:
1 <=T<= 100
1 <=N<= 1000
1 <=arr[i]<= 1000

Design algorithm , flow chart ,program using the above data requirements for the given problem Try the sample test cases given below :

SAMPLE TEST CASES	INPUT	OUPUT
Test case 1	2 5 4 1 3 9 7 10 10 9 8 7 6 5 4 3 2 1	1 3 4 7 9 1 2 3 4 5 6 7 8 9 10
Test case 2	1 5 8 9 3 2 0	0 2 3 8 9

6. TEXT EDITOR

PROBLEM STATEMENT: Design and implement a program to perform editing operations on a line of text. Your editor should be able to locate a specified target substring, delete a substring,and insert a substring at a specified location. The editor should expect source stringsof less than 80 characters.

Problem Constant MAX_LEN 100 /* maximum size of a string */
Problem Inputs
char source[MAX_LEN] /* source string */
char command /* edit command */
Problem Output

char source[MAX_LEN]   /* modified source string */

Design algorithm , flow chart ,program using the above data requirements for the given problem Try the sample test cases given below :

SAMPLE TEST CASES	**INPUT**	**OUPUT**
Test case 1	Enter the source string: > Internet use is growing rapidly. Enter D(Delete), I(Insert), F(Find), or Q(Quit)> d String to delete> growing	New source: Internet use is rapidly
Test case 2	Enter D(Delete), I(Insert), F(Find), or Q(Quit)> F String to find>**.**	'.' found at position 23

7. ARITHMETIC WITH COMMON FRACTIONS

PROBLEM STATEMENT: You are working problems in which you must display your results as integer ratios; therefore, you need to be able to perform computations with common fractions and getresults that are common fractions in reduced form. You want to write a program thatwill allow you to add, subtract, multiply, and divide several pairs of common fractions.

Design algorithm, flow chart, program using the above data requirements for the given problem
Try the sample test cases given below :

SAMPLE TEST CASES	**INPUT 1**	**OUPUT**
Test case 1	Enter a common fraction as two integers separated by a slash> 3/-4	Input invalid—denominator must be positive
Test case 2	Enter a common fraction as two integers separated by a slash> 3/4 Enter an arithmetic operator (+,-,*, or /) > + Enter a common fraction as two integers separated by a slash> 5/8 Entering find_gcd with n1 = 44, n2 = 32 Do another problem? (y/n)>n	gcd of 44 and 32?> 4 find_gcd returning 4 3/4 + 5/8 = 11/8

8. FACTORIAL OF A NUMBER

PROBLEM STATEMENT: Find factorial of a given number n.

Design algorithm , flow chart ,program using the above data requirements for the given problem Try the sample test cases given below :

SAMPLE TEST CASES	**INPUT 1**	**OUPUT**
Test case 1	Enter a number to find factorial>2	Factorial of 2 is 4
Test case 2	Enter a number to find factorial>3	Factorial of 3 is 6

9. COLLECTING AREA FOR SOLAR-HEATED HOUSE – FILES AND FUNCTIONS

PROBLEM STATEMENT : An architect needs a program that can estimate the appropriate size for the collecting area of a solar-heated house. Determining collecting area size requiresconsideration of several factors, including the average number of heating degreedays for the coldest month of a year (the product of the average difference betweeninside and outside temperatures and the number of days in the month), the heating requirement per square foot of floor space, the floor space, and the efficiency ofthe collection method. The program will have access to two data files. File hdd.txtcontains numbers representing the average heating degree days in the constructionlocation for each of 12 months. File solar.txt contains the average solar insolation(rate in BTU/day at which solar radiation falls on one square foot of a given location)for each month. The first entry in each file represents data for January, the second,data for February, and so on.

Problem Inputs

Average heating degree days file
Average solar insolation file
heat_deg_days /* average heating degree days for coldest month */
coldest_mon /* coldest month (number 1 .. 12) */
solar_insol /* average daily solar insolation (BTU/ft^2)for coldest month */
heating_req /* BTU/degree day ft^2 for planned type construction*/
efficiency /* % of solar insolation converted to usable heat */
floor_space /* square feet */

Program Variables

energy_resrc /* usable solar energy available in coldest month (BTUs obtained from 1 ft^2 of collecting area) */

Problem Outputs

heat_loss /* BTUs of heat lost by structure in coldest month */
collect_area /* approximate size (ft^2) of collecting area needed*/

The formula for approximating the desired collecting area (A) is :

A= heat loss / energy resource

Design algorithm , flow chart ,program using the above data requirements for the given problem
Try the sample test cases given below :

SAMPLE TEST CASES	INPUT	OUPUT
Test case 1	What is the approximate heating requirement (BTU / degree day ft^2) of this type of construction? =>9 What percent of solar insolation will be converted to usable heat? => 60 What is the floor space (ft^2)? => 1200	To replace heat loss of 11350800 BTU in the coldest month (month 12) with available solar insolation of 500 BTU / ft^2 / day, and an efficiency of 60 percent, use a solar collecting area of 1221 ft^2.
Test case 2	What is the approximate heating requirement (BTU / degree day ft^2) of this type of construction? =>10 What percent of solar insolation will be converted to usable heat? => 60 What is the floor space (ft^2)? => 1200	To replace heat loss of 12612000 BTU in the coldest month (month 12) with available solar insolation of 500 BTU / ft^2 / day, and an efficiency of 60 percent, use a solar collecting area of 1221 ft^2.

Q10. UNIVERSAL MEASUREMENT CONVERSION

PROBLEM STATEMENT: Design a program that takes a measurement in one unit (e.g., 4.5 quarts) and converts it to another unit (e.g., liters). For example, this conversion request 450 km miles would result in this program output Attempting conversion of 450.0000 km to miles . . . 450.0000km = 279.6247 miles . The program should produce an error message if a conversion between two unitsof different classes (e.g., liquid volume to distance) is requested. The programshould take a database of conversion information from an input file before acceptingconversion problems entered interactively by the user. The user should be able tospecify units either by name (e.g., kilograms) or by abbreviation (e.g., kg).

Structured Data Type

unit_members :

name /* character string such as "milligrams" */
abbrev /* shorter character string such as "mg" */
class /* character string "liquid_volume", "distance", or "mass" */
standard /* number of standard units that are equivalent to this unit */

Problem Constants

NAME_LEN 30 /* storage allocated for a unit name */
ABBREV_LEN 15 /* storage allocated for a unit abbreviation */
CLASS_LEN 20 /* storage allocated for a measurement class */
MAX_UNITS 20 /* maximum number of different units handled */

Problem Inputs

unit_t units[MAX_UNITS] /* array representing unit conversion factors database */
double quantity /* value to convert */
charold_units[NAME_LEN] /* name or abbreviation of units to be converted */
charnew_units[NAME_LEN] /* name or abbreviation of units to convert to */

Problem Output

Message giving conversion.

***Data file* units.txt:**

miles mi distance 1609.3
kilometers km distance 1000
yards yd distance 0.9144
meters m distance 1
quartsqtliquid_volume 0.94635
liters l liquid_volume 1
gallons gal liquid_volume 3.7854
milliliters ml liquid_volume 0.001
kilograms kg mass 1
grams g mass 0.001
slugsslugs mass 0.14594
poundslb mass 0.43592

Design algorithm , flow chart ,program using the above data requirements for the given problem

Try the sample test cases given below :

SAMPLE TEST CASES	**INPUT 1**	**OUPUT**
Test case 1	Enter a conversion problem or q to quit. To convert 25 kilometers to miles, you would enter > 25 kilometers miles	>450 km miles Attempting conversion of 450.0000 km to miles . . . 450.0000km = 279.6247 miles

	or, alternatively, > 25 km mi	
Test case 2	Enter a conversion problem or q to quit. > 2.5 qt l Attempting conversion of 2.5000 qt to l . . . 2.5000qt = 2.3659 l Enter a conversion problem or q to quit.	> 100 meters gallons Attempting conversion of 100.0000 meters to gallons . . . Cannot convert meters (distance) to gallons (liquid_volume)

ADDITIONAL PROGRAMS

Problem solving programs:

1. **Chocolate feast :** Little Bob loves chocolates, and goes to a store with $N in his pocket. The price of each chocolate is $C. The store offers a discount: for every M wrappers he gives to the store, he gets one chocolate for free. How many chocolates does Bob get to eat? Note : Evaluate the number of wraps after each step. Do this until you have enough wraps to buy new chocolates.
2. **Angry Professor :**The professor is. Given the arrival time of each student, your task is to find out if the class gets cancelled or conducting a course on Discrete Mathematics to a class of N students. He is angry at the lack of their discipline, and he decides to cancel the class if there are less than K students present after the class startsnot.
3. **Divisible Sum Pairs :** You are given an array of n integers and a positive integer, k. Find and print the number of (i,j) pairs where i< j and ai + aj is evenly divisible by k.
4. **Sherlock And Valid String:** A "valid" string is a string S such that for all distinct characters in S each such character occurs the same number of times in S. Note :The logic of the solution is as follows: count the character counts for each character. Note : if they are all equal – it means that all characters occur exactly N times and there is no removal needed .if 2 or more have less or more characters – there is no way to fix the string in just 1 removal . if exactly 1 char has a different count than all other characters – remove this char completely and S is fixed.
5. **Ice Cream Parlor :**Sunny and Johnny together have M dollars they want to spend on ice cream. The parlor offers N flavors, and they want to choose two flavors so that they end up spending the whole amount. You are given the cost of these flavors. The cost of the ith flavor is denoted by ci. You have to display the indices of the two flavors whose sum is M.
6. **'Missing Numbers' :**Numeros, the Artist, had two lists A and B, such that B was a permutation of A. Numeros was very proud of these lists. Unfortunately, while transporting them from one exhibition to another, some numbers from A got left out. Can you find the numbers missing?
7. **Alternating Characters:** John likes strings in which consecutive characters are different. For example, he likes ABABA, while he doesn't like ABAA. Given a string containing characters A and B only, he wants to change it into a string he likes. To do this, he is allowed to delete the characters in the string.
8. **Game Of Thrones :** I : Dothraki are planning an attack to usurp King Robert's throne. King Robert learns of this conspiracy from Raven and plans to lock the single door through which the enemy can enter his kingdom door. But, to lock the door he needs a key that is an anagram of a palindrome. He starts to go through his box of strings, checking to see if they can be rearranged into a palindrome.For example, given the string ,s=[aabbccdd] one way it can be arranged into a palindrome is abcddcba .
9. **Life and everything :** Your program is to use the brute-force approach in order to find the Answer to Life, the Universe, and Everything. More precisely... rewrite small numbers from input to output. Stop processing input after reading in the number 42. All numbers at input are integers of one or two digits.
   input: 1 2 23 22 42
   output: 1 2 23 22
10. **Filling Jars :**Animesh has N empty candy jars, numbered from 1 to N, with infinite capacity. He performs M operations. Each operation is described by 3 integers a, b and k. Here, a and b are indices of the jars, and k is the number of candies to be added inside each jar whose index lies betweena and b (both inclusive). Can you tell the average number of candies after M operations?

Reference Books:

(1) Jeri R. Hanly , Elliot B .Koffman , Problem solving and program Design in C , 7th Edition
(2) Computer Science: A Structured Programming Approach Using C, B. A. Forouzan and R. F. Gilberg, Third Edition, Cengage Learning.
(3) Dietal&Deital , C How to Program 7/E ,PHI Publications

Web References :

- https://www.spoj.com/
- https://projecteuler.net/
- https://www.hackerearth.com/practice/
- https://www.codechef.com/
- https://onlinecourses.nptel.ac.in/

Instructions to the instructor:

This lab course consists of two set of programs
1) Minimum set of sample programs
2) Additional set of programs

Minimum set of sample programs are designed unit wise covering all the topics in the theory .
Additional set of programs are designed basing on problem solving

Sessional marks : 50 marks

1) Daily Evaluation (Includes Record, Observation & regular performance) – 30 marks
2) Attendance – 5 marks
3) Internal Exam – 10 marks
4) Viva Voce – 5 marks

Daily Evaluation (30 marks)

- Every Student must execute minimum set of sample programs to secure 60% of marks in Daily Evaluation i.e. 18 Marks and to appear in external examination.
- In addition to that if a student finishes the minimum set and 5 programs from additional set of programs would secure 80% of marks in Daily Evaluation i.e. 24 Marks.
- If a student finishes all the programs in both the set s will secure 100% of marks in Daily Evaluation

Internal Exam (10 marks)

- Every student is given 4 questions in the internal exam out of which the difficulty level of 2 questions is easy / medium and 2 questions of difficulty level is high
- Each easy / medium level question carries 20% of marks and difficulty level question carries 30% of marks

External Exam (50 marks)

- Viva voce – 10 marks
- Write up + Execution – 40 marks

Write up + Execution (40 marks)

- Every student is given 4 questions in the external exam out of which the difficulty level of 2 questions is easy / medium and 2 questions of difficulty level is high
- Each easy / medium level question carries 30% of marks and difficulty level question carries 20% of marks.

ENGINEERING MATHEMATICS-III

(Common for Chemical, Mechanical, EEE and ECE)

CHE 211 **Credits: 3**
Instruction: 3 periods & 1 tutorial / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course outcomes:

At the end of the course student will be able to:

1. Understand the concepts of Gradient, Divergence and Curl and finding scalar potential function of irrotational vector fields.
2. Understand the concepts of Green's, Stoke's, Divergence theorems and evaluate their related integrals like line, surface, flux.
3. Understand some basic techniques for solving partial differential equations.
4. Apply the knowledge of partial differential equations to various engineering problems.
5. Understand the characteristics, properties of Fourier transforms and gain knowledge in the application of Fourier Transforms.

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	1	2	2								1	1	1
	2	3	1	2	2								1	1	1
	3	3	1	1	1								1	2	2
	4	3	1	2	2								1	2	2
	5	3	1	1	1								1	1	1

UNIT I: VECTOR DIFFERENTIATION **9L + 3T**

Differentiation of Vectors – Scalar and Vector point function – Del applied to Scalar point functions - Gradient geometrical interpretations – Directional Derivative - Del applied to vector point function – divergence - Curl – Physical interpretation of Divergence and Curl - Del applied twice to point functions- Del applied to product of point functions.

UNIT II: VECTOR INTEGRATION 9L + 3T

Integration of vectors – Line integral – Surface – Green's theorem in the plane – Stokes theorem – Volume integral – Gauss Divergence theorems (all theorems without proofs) – Irrotational fields .

UNIT III: PARTIAL DIFFERENTIAL EQUATIONS 9L + 3T

Introduction – Formation of Partial Differential Equations – Solution of Partial Differential Equations by Direct Integration – Linear Equations of the First order – Higher order Linear Equations with Constant Co-efficients – Rules for finding the complementary function - Rules for finding the Particular integral – Non- Homogeneous linear equations with constant coefficients.

UNIT IV: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9L + 3T

Introduction – Method of separation of variables – Vibrations of a stretched string-Wave equation – One dimensional Heat flow - Two dimensional Heat flow – Solution of Laplace's equation.- Laplace's equation in Polar Co-ordinates.

UNITV: FOURIER TRANSFORMS 9L + 3T

Introduction – definition – Fourier integral theorem - Fourier sine and cosine integrals – Complex form of Fourier integrals – Fourier integral representation of a function – Fourier Transforms – Properties of Fourier Transforms – Convolution Theorem – Parseval's identity for Fourier transforms – Fourier Transforms of the Derivatives of functions – Application of Transforms to Boundary value problems – Heat conduction – Vibrations of a string.

Text Books:

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", 43rd ed., Khanna Publishers,New Dehli.

Reference books:

1. N.P. Bali etal, "A Text book on Engineering Mathematics", 8th ed., Laxmi pub.(p)Ltd., 2011.
2. H.K.Dass , "Advanced. Engineering Mathematics", 1st ed., S. Chand, 2008.
3. Erwin kreyszig , "Advanced Engineering Mathematics", 10th ed., wiley publishers.
4. Dr.M.K. Venkataraman, "Higher Engineering Mathematics", National Pub.Co.,Madras.

ORGANIC CHEMISTRY

CHE212 **Credits: 3**

Instruction: 3 periods & 1 tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Course Objectives:

1. To impart knowledge on the basic concepts of organic chemistry.
2. To know the importance of stereo chemical approach of organic reactions.
3. To create basic idea on the mechanism of organic reactions involving reaction intermediates.
4. To understand the industrial preparation methods of certain organic compounds and their synthetic applications.
5. To create awareness on various applications of chemical reagents and biological activity of few organic compounds.

Course Outcomes:

At the end of the course, the student will be able to:

1. Understand the basics of reaction intermediates and polar effects.
2. Design organic molecules in stereo chemical models.
3. Arrive at an idea on mechanism of addition and condensation reactions.
4. Meet the need to understand the industrial preparation of organic compounds at various conditions.
5. Develop further organic applications using synthetic reagents and understand the biological activity of few organic compounds.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1										1	1	1
	2	3		2									1	1	1
	3	3	1	1	1								1	1	1
	4	3	1	1									1	1	1
	5	3	1	1									1	1	1

UNIT I **9L +3T**

FUNDAMENTALS OF ORGANIC CHEMISTRY:

Introduction to organic functional groups- IUPAC nomenclature and Isomerism.Organic reactions – Types-addition, elimination, substitution, rearrangement, polymerization-examples.Types of reagents- electrophile, nucleophile. Reaction intermediates &hybridisation-carbocation, carbanion, free-radical, examples. Polar effects – Inductive effect, mesomeric effect, electromeric effect and Hyper conjugation with examples; Acidic nature of carboxylic acid and phenol; basic nature of Amines.

UNIT II **9L +3T**

STEREOCHEMISTRY OF ORGANIC COMPOUNDS:

Stereosisomerism- definition-types. Representation of compounds – saw horse projection, newmann projection, fisher-projection, wedge formula- examples.Conformational isomerism-examples of ethane, n-butane, cyclohexane & potential energy diagrams.Axial & equatorial bonds in cyclohexane- Examples of 1,2& 1,3 interactions in substituted cyclohexanes.Geometrical isomerism- Cis-trans & E-Z isomerism-sequence rules and examples.R & S configuration- sequence rules-examples.Optical activity- chirality.Enantiomers, diastereomers, mesomers, racemic mixture.Racemisation, Resolution of racemic mixture.

UNIT III **9L +3T**

CHEMISTRY OF ALCOHOLS, PHENOLS & CARBONYL COMPOUNDS:

Industrial Preparations of Ethyl alcohol(molasses), Differences between alcohols- oxidation, Lucas Test, catalytic dehydrogenation, victor-meyer test. Chemical reactions of phenols- Fries rearrangement, Kolbes reaction ,Reimar-tiemann reaction.Reactivity of carbonyl compounds. Chemical reactions-Cannizaro, Aldol, Reformatsky and Wittig reactions, Perkin, Cope, Knoevenagel and Pinacol-Pinacolone reactions, Differences between Aldehyde and Ketone.

UNIT IV **9L +3T**

CHEMISTRY OF CARBOXYLIC ACIDS& DERIVATIVES & AMINES:

Industrial Preparations of Acidic acid, chemical reactions- Hell-Volhard-Zelinsky reaction, Wolf rearrangement.Functional derivatives of carboxylic acids- esters (acid &base catalyzed hydrolysis of Ester, Claisen condensation), amides, (Hoffmann Bromamide reaction) and acid halides (Rosenmunds reduction).Aniline preparation, differences between amines and chemical reactions - Hoffmann elimination, Hinsberg test, mustard oil test, carbyl amine reaction.Benzene Diazonium salts and Synthetic applications-coupling reactions, Schiemann reaction, Gatterman reaction, Sandmayer reaction.

UNIT V **9L +3T**

HETEROCYCLIC COMPOUNDS & SYNTHETIC APPLICATIONS OF SOME ORGANIC REAGENTS:

Aromaticity, Preparation, Properties and uses of –Five membered heterocyclic compounds- Pyrrole, Furan, Thiophene, Indole.Six membered heterocyclic compounds- Pyridine, Quinoline.Elementary idea on mode of action of sulpha drugs (Sulphanilamide, Sulphapyridene).Chemical nature and Synthetic applications of $LiAlH_4$and OsO_4.

Text Books:

1. ArunBahl and B.S.Bahl, “Text Book of Organic Chemistry”, 21st ed., S.Chand, 2012.
2. Morrison & Boyd, “Text Book of Organic Chemistry”, 7th ed. Pearson, 2008.

Reference Books:

1. Jerry March, “Organic chemistry”, 6th ed., Wiley ind. (P).Ltd., 2012
2. I.L.Finar, “Text Book of Organic Chemistry” 7th ed., Vol.1&2, Pearson, 2011.

MECHANICAL ENGINEERINGANDSTRENGTH OF MATERIALS

CHE 213 **Credits: 3**

Instruction: 3 periods & 1 tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Course Objectives:

1. To provide knowledge on thermodynamic laws and their applications.
2. To impartknowledge on boilers and use of steam tables.
3. To provide knowledge on various types of IC engines.
4. To impart knowledge on stress and strain concepts.
5. To provide knowledge on stress relations in various types of shells.

Course Outcomes:

By the end of the course, student will be able to

1. Understand the application of thermodynamic laws.
2. Identify the use of boilers in industries.
3. Classify IC engines and their applications.
4. Evaluate stress-strain analysis
5. Understand the design of thin and thick cylinders.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1	1	1								1	1	1
	2	3	1												
	3	3	1												
	4	3	1	1									1	1	1
	5	3	1	1									1	1	1

Part A: Mechanical Engineering

UNIT I: Thermodynamics **9L +3T**

Definitions, systems, classification of thermodynamic systems, cycle, and zeroth law of thermodynamics, first law of thermodynamics, Second law of thermodynamics, Carnot cycle, inequality of Classius-reversible Carnot cycle, entropy, general expression for entropy change, entropy change of a perfect gas during various thermodynamic processes, air standard cycles, Otto, diesel, dual combustion cycles.

UNIT II: Boilers **9L +3T**

Properties of steam and use of steam tables,Boilers, classification steam boilers, simple vertical, Cocheran locomotive boiler, Babcock and Wilcox boiler, steam generation, Rankine cycle.

UNITIII: IC engines **9L +3T**

Classification-main composition of IC engines, carburetter, fuel pump injector, cooling systems for IC engines, working of 2-stroke and v4- stroke petrol and diesel engines, power and efficiency of IC engines.

Part B: Strength of Materials

UNIT IV: Simple stress and strains **9L +3T**

Hook's law, stress strain curve for mild steel, stress in compound assemblies, thermal stresses, Poisson ratio, relation between elastic modulus, Principal stresses and principal planes, maximum shear stress and its plane.

UNITV: Thin and Thick Cylinders **9L +3T**

Stress in thin cylindrical shells and spherical shells, stress in thick cylinders, compound cylinders, pressure due to shrink-fitting.

Text books:

1. P.K.Nag, "Engineering Thermodynamics",5th ed., McGraw Hill education, 2013.
2. V. Ganeshan, "Internal Combution Engines", 4th ed., McGraw Hill education,2012.
3. Ramamrutaham, "Strength of Materials", 18th ed., Dhanpati Publishing Company (P) Ltd., 2014.

Reference books:

1. J.B.Jones and R.E.Dugar, "Engineering Thermodynamics", 1st ed., PHI Learning, 2009.
2. R.K.Rajput, "A Text Book of Engineering Thermodynamics", 4th ed. Laxmi Publications, 2007.
3. E. Popov, "Mechanics of solids" Prentice Hall, 1998.

CHEMICAL PROCESS CALCULATIONS

CHE 215 **Credits: 4**

Instruction: 4 periods & 1 tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Course Objectives:

1. To master fundamentals of stoichiometry and gas laws.
2. To familiarize and to apply material and energy balance for various chemical operations and processes
3. Utilize the knowledge of subject for better understanding of core subjects

Course Outcomes:

By the end of the course, student will be able to

1. Understand and solve basic stoichiometry calculations.
2. Evaluate composition of gases at various temperatures and pressures.
3. Apply material balance on various unit operation and processes.
4. Apply energy balance on various unit operation and processes.
5. Implement the concepts of humidity to humidification and dehumidification processes.

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	1		1	1							1	2	2
	2	3	1		1			1					1	2	2
	3	3	2	2	1			1					1	2	3
	4	3	2	2	1			1					1	2	3
	5	3	1	1	1								1	2	3

UNIT I **12L +3T**

Stoichiometry and composition relationships:

The gram-mole and pound-mole, limiting reactant, excess reactant, degree of completion, basis of calculation, weight percent, volume percent and mole percent, density and specific gravity-Baume and API gravity scales.

UNIT II **12L +3T**

Behavior of ideal gases:

Application of the ideal-gas law, Dalton and Amagat laws to gaseous mixtures, composition of gases on dry basis and on wet basis.

UNIT III **12L +3T**

Material Balances: Tie substance, yield, conversion, and processes involving chemical reactions, material balance- calculations involving drying, dissolution, and crystallization, processes involving recycle, bypass and purge.

UNIT IV **12L +3T**

Energy Balances:

Effect of temperature on vapor pressure, Antoine equation, vapor pressure plots, vapor pressure of immiscible liquids, ideal solutions and Raoult's law, non-volatile solutes.
Heat capacities of gases and gaseous mixtures- effect of temperature on heat capacity of gas, Kopp's rule, latent heatsof fusion and vaporization, Trouton's rule, Kistyakowsky equation for non-polar liquids.
Standard heat of reaction - Laws of thermochemistry,Standard heat of formation, standard heat of combustion, standard heat of reaction and their calculations,effect of temperature on heat of reaction, adiabatic and non-adiabatic reactions, theoretical and actual flame temperatures.

UNIT V **12L +3T**

Humidity:

Percentage saturation, relative saturation or relative humidity, dew point, vaporization, condensation, wet and dry bulb temperatures, adiabatic vaporization and adiabatic saturation temperature.

Text books:

1. David M. Himmelblau,"Basic principles and Calculations in Chemical Engineering", 6th ed., Prentice Hall of India Pvt Ltd, 1995.

Reference books:

1. Olaf A Hougen, K.M. Watson and R.A.Ragatz, "Chemical Process Principles, Part-I - Material and Energy balances"2nd ed., CBS Publishers and Distributors,1995.
2. K.V. Narayanan and B. Lakshmikutty, "Stoichiometry and Process Calculations", 5th ed., Prentice Hall of India Pvt Ltd , 2006.
3. B.I. Bhatt and S.M. Vora, "Stoichiometry", 3rded., Tata McGraw Hill Publishing Company Limited, New Delhi, 1996.

ORGANIC CHEMISTRY LABORATORY

CHE216 **Credits: 2**

Practical/week:3 Sessional Marks: 50

End Exam: 3 Hours End Exam Marks:50

Course Objectives:

1. To improve skills in synthesizing organic compounds using various chemical techniques.
2. To enable the students to analyze the functional group in the organic compound through qualitative analysis.

Course Outcomes:
At the end of the course, the student will be able to:

1. Synthesize and analyze the properties and nature of the organic compound.
2. Use different types of solvents and reagents in analyzing the functional group of the organic compound.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	2	2					1	3		1	1	1
	2	3	2	2	2					1	3		1	1	1

LIST OF EXPERIMENTS:

CYCLE-1

One step synthesis or Microwave assisted synthesis of organic compounds and determination of melting point:

1. Phthalimide
2. Nerolin
3. Benzanilide
4. Aspirin
5. m-dinitrobenzene
6. Methyl Orange

CYCLE-2
Qualitative analysis for the identification of functional group in the organic compound:

1. Demonstration of Qualitative analysis
2. Analysis of Compound -1
3. Analysis of Compound -2
4. Analysis of Compound -3
5. Analysis of Compound -4
6. Analysis of Compound -5
7. Analysis of Compound -6

Text book:

1. Organic Chemistry Lab Manual prepared by Department of Chemistry.

Reference book:

1. Vogel's textbook of Practical Organic Chemistry, 5th edition, Pearson education.

MECHANICAL ENGINEERING LABORATORY

CHE217 **Credits: 2**

Practical/week:3 Sessional Marks: 50

End Exam: 3 Hours End Exam Marks:50

Course Objectives:

1. To improve skills in measuring the physical properties of a given sample.
2. To enable the students to familiarize with the load test and valve timing diagram.

Course Outcomes:

At the end of the course, the student will be able to:

1. Measure the physical properties of a given sample.
2. Perform the load test and draw the performance curves.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1	1	1					1	3		1	1	1
	2	3	1	1	1					1	3		1	1	1

List of experiments:

1. Find the viscosity of the given sample of oil using Redwood viscometer-1
2. Find the viscosity of the given sample of oil using Redwood viscometer-II
3. Find the flash point of the given sample of oil using Abel's flash point tester
4. To calibrate pressure gauge using standard pressure and standard weights
5. Draw the valve timing diagram of a 4-stroke diesel engine and port timing diagram of a 2-stroke petrol engine
6. Perform load test at full load, half load, ¼ th load on a 4-stroke Ruston engine and draw the performance curves
7. Find the volumetric efficiency, isothermal efficiency of the given compressor
8. To determine the moment of inertia of a fly-wheel and shaft experimentally and compare the values with the calculated values
9. To determine experimentally the calorific value of a gaseous fuel by using Junkers gas calorimeter
10. To determine the modulus of rigidity of the material of the wire by torsional oscillators

Text Book:

1. V. Ganeshan, "Internal Combution Engines", 4th ed., McGraw Hill education, 2012.

Reference Book:

1. R.K.Rajput, "A Text Book of Engineering Thermodynamics", 4th edition. Laxmi Publications, 2007.

ENGINEERING MATHEMATICS-IV

(Common for Chemical and Mechanical)

CHE 221 **Credits: 3**
Instruction: 3 periods & 1 tutorial / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Outcomes: At the end of the course student will be able to:

1. Understand, interpret and use the basic concepts: analytic function, harmonic function, Taylor and Laurent series, singularity.
2. Familiarize the concepts of Finite Differencesinterpolation techniques.
3. Familiarize the concept and solving of differentiation and integration by numerical methods.
4. Examine, analyze, and compare Probability distributions.
5. Analyze the Statistical data by using statistical tests and to draw valid inferences about the population parameters.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1	1	1								1	1	1
	2	3	1	2	2								1	2	2
	3	3	1	2	2								1	2	2
	4	3	1	2	2							1	1	2	2
	5	3	1	2	2							1	1	2	2

UNITI: FUNCTIONS OF A COMPLEX VARIABLE **9L + 3T**

Introduction –Limit of a Complex function- Derivative of $f(z)$ – Analytic functions-Harmonic functions - Applications to Flow problems. Complex Integration- Cauchy's Theorem-Cauchy's Integral Formula –Series of Complex terms(Statements of Taylor's and Laurent's Series without proof) - Zeros of an Analytic function .

UNIT II: FINITE DIFFERENCES & INTERPOLATION 9L + 3T

Finite Differences – Forward differences – Backward differences – Central differences – Differences of a Polynomial – Factorial Notation – Other difference operators – To find one or more missing terms – Newton's Interpolation Formulae – Central Difference Interpolation Formulae - Interpolation with Unequal Intervals – Lagrange's interpolation formula – Inverse Interpolation.

UNITIII: NUMERICAL DIFFERENTIATION AND INTEGRATION 9L + 3T

Numerical Differentiation – Formulae for derivatives – Maxima and Minima of a Tabulated Function – Numerical Integration – Newton-Cotes Quadrature Formula – Trapezoidal rule – Simpson's One-Third rule, Simpson's Three-Eighth rule.

UNIT IV: PROBABILITY AND DISTRIBUTIONS 9L + 3T

Introduction – Basic Terminology – Probability and set notations – Addition Law of Probability – Independent events – Baye's Theorem – Random variable – Discrete Probability Distribution – Continuous Probability Distribution – Binomial Distribution - Poisson distribution - Normal Distribution. (Mean , Variance , Standard Deviation and their properties without proofs).

UNIT V: SAMPLING THEORY 9L + 3T

Introduction – Sampling Distribution – Testing a hypothesis – Level of Significance – Confidence Limits – Test of Significance of Large samples (Test of significance of single mean, difference of means) – Confidence limits for unknown – Small samples – Students t-distribution – Significance test of a sample mean – Significance test of difference between sample means – Chi-Square (χ^2) Test – Goodness of fit.

Text Books:

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", 43rd ed., Khanna Publishers, New Dehli.

Reference books:

1. N.P. Bali et al, "A Text book on Engineering Mathematics", 8th ed., Laxmi pub.(p) Ltd., 2011.
2. H.K.Dass , "Advanced. Engineering Mathematics", 1st ed., S. Chand, 2008.
3. Erwin kreyszig , "Advanced Engineering Mathematics", 10th ed., wiley publishers.
4. Dr.M.K. Venkataraman, "Higher Engineering Mathematics", National Pub.Co., Madras.

MOMENTUM TRANSFER

CHE 222 **Credits: 4**

Instruction: 4 periods & 1 tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Course Objectives:

1. To provide an understanding of fluid mechanics and its scope in the chemical industry.
2. To impart fundamental concepts in fluid mechanics with the knowledge of applying basic quantitative laws and the equations of fluid flow.
3. To provide the basic knowledge on compressible fluids, pressure drop, friction factor, Reynolds number and their relations in flow systems.
4. To provide an understanding about flow past immersed bodies and fluidization.
5. To acquaint knowledge on fluid moving machinery and flow measuring devices.

Course Outcomes:

After studying this subject, student will be able to

1. Understand the fluid statics and apply dimensional analysis
2. Apply quantitative laws to fluid flow problems.
3. Analyze the velocity distributions, frictional flow patterns in pipes.
4. Determine the pressure drop, velocities in packed and fluidized bed columns.
5. Analyze the performance aspects of pumps and flow metering devices.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2		1					1	1		1	2	3
	2	3	2	3	1					1	1		1	2	3
	3	3	2	2	1					1	1		1	2	3
	4	3	2	2	1					1	1		1	2	3
	5	3	2	2	2					1	1		1	2	3

UNIT I **12L + 3T**

Basic concepts: Unit systems, units and dimensions, dimensional analysis – Rayleigh's method, Buckingham π theorem, equations of state, similarity.

Fluid statics: Nature of fluids, hydrostatic pressure, pressure distribution in a static fluid, pressure measuring devices.

UNIT II **12L + 3T**

Fluid flow phenomenon: Types of fluids, concept of stream lines, stream tubes, viscosity, rheological properties of fluids, turbulence, flow in boundary layers, its formation and growth in tubes and on plates, boundary layer separation.

Basic equations of fluid flow: Mass balance, steady state energy balance, equation of motion, momentum balance and Bernoulli's equation with the correction factors.

UNIT III **12L + 3T**

Flow of incompressible fluids: Relation between skin friction - wall shear, laminar flow in pipes, Hagen-Poiseuille equation, turbulent flow in pipes, velocity distribution equation, friction factor, friction from changes in velocity or direction.

Flow of compressible fluids: Basic equations, Mach number, flow through variable area conduits, adiabatic and isothermal frictional flow.

UNIT IV **12L + 3T**

Flow past immersed bodies: Flow through beds of solids, motion of particles through fluids, terminal velocity, fluidization, mechanism of fluidization, pressure drop in fluidization, applications of fluidization.

UNIT V **12L + 3T**

Transportation and metering of fluids: Pipes, fittings, valves, positive displacement and centrifugal pumps, fans, blowers and compressors, jet ejectors.

Flow measuring devices: venture meter, orifice meter, pitot tube, rotameter, notches and weirs.

Textbooks:

1. Warren L.McCabe and Julian C.Smith, "Unit Operations of Chemical Engineering", 7th ed., McGraw Hill, 2005.
2. R. K. Bansal, " A Text Book of Fluid Mechanics and Hydraulic Machines", 8th ed., Laxmi publisher, 2008. (for topics Unit systems, units and dimensions, dimensional analysis,notches and weirs)

Reference Books:

1. De Nevers N., "Fluid mechanics for chemical engineers", 3rd ed., McGraw Hill.
2. J.M.Coulson, J.F.Richardson, "Chemical engineering", 5th ed., Vol –I & II,,Elseveir,1999.
3. Cengel and Cimbala, "Fundamentals of fluid mechanics", 3rd ed.,McGraw Hill Education,2014.
4. R. K. Rajput, " A Text Book of Fluid Mechanics and Hydraulic Machines", 3rd ed., S. Chand, 2002.

MECHANICAL OPERATIONS

CHE 223 **Credits: 4**

Instruction: 4 periods & 1 tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Course Objectives:

1. To familiarize with characteristics of solids, size reduction aspects, working of various size reduction equipment and its operations.
2. To know about the different screening techniques and screening equipments and other separation methods.
3. To understand the principles of filtration and the working of different filtration and centrifugation equipments.
4. To understand the principles of settling of solids in fluids and sedimentation.
5. To understand the concept of agitation and mixing of liquids.

Course Outcomes:

After studying this subject, student wii be able to

1. Identify the size reduction equipment for various samples.
2. Apply the screening techniques for different size separations.
3. Understand and apply the filtration techniques.
4. Predict the different settling regimes.
5. Classify various agitators and conveyors.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1	1	2					1	1		1	2	3
	2	2	1	1	1					1	1		1	2	3
	3	2	1	1	1					1	1		1	2	3
	4	2	1	1	1					1	1		1	2	3
	5	2	1	1	1					1	1		1	2	3

UNIT I **12L + 3T**

Characteristics of solid particles: shape, size, differential and cumulative screen analyses, specific surface area, particle population, different mean diameters for a mixture of particles.**Principles of comminution:** Laws of crushing, description and working of size reduction equipment - jaw, gyratory and roll crushers, hammer mills, revolving mills, attrition mills, fluid energy mill, cutting machines, equipment operations, open and closed circuit grinding, wet and dry grinding, Grindability Index.

UNIT II **12L + 3T**

Miscellaneous separations: screening, industrial screens - grizzly, gyratory and vibratory screens, revolving screens - trommels, capacity and effectiveness of screens, magnetic separation, electrostatic separation, froth flotation.

UNIT III **12L + 3T**

Filtration: description and working of filtration equipment, plate and frame filter press, shell and leaf filters, rotary drum filter, filter aid, centrifugal filtration, top suspended batch centrifuge, theory of filtration, washing of cakes.

UNIT IV **12L + 3T**

Motion of particles through fluids: drag, free and hindered settling, settling velocities, classification, sink and float methods, differential setting methods - jigging and tabling, cyclone separators, batch sedimentation,thickeners, flocculation, centrifugal sedimentation, gravity and centrifugal decanters.

UNIT V **12L + 3T**

Agitation of liquids: power consumption in agitated vessels, mixing equipment for mixing of solids and pastes, mixers for dry powders, mixing index.

Conveying: types of conveyors – mechanical, belt, chain and screw conveyors, elevators, pneumatic conveyors, size enlargement.

Text books:

1. W.L. McCabe, J.C. Smith and P.Harriot, “Unit Operations of Chemical Engineering”, 4th ed., McGraw- Hill.
2. J.H.Coulson and J.F.Richardson, “Chemical Engineering -Vol.2” 5th ed., Elsevier Science, 2002 (for topics of trommels, magnetic separator, electrostatic separator and froth flotation).

Reference books:

1. R.H.Perry,“Chemical Engineer’s Hand Book”,8th ed., McGraw-Hill Book Co., 2007.
2. Brown et al., “Unit Operations”, 1st ed., CBS Publisher,2005.
3. Badger and Banchero, “Introduction to Chemical Engineering”, 1st ed.,McGraw-Hill, 2002.(forconveying topic).

PROCESS INSTRUMENTATION

CHE 224 **Credits: 4**

Instruction: 4 periods & 1 tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Course Objectives:

1. To familiarize with characteristics of instruments and their response, types of layouts for the process instrumentation.
2. To know about the principles of expansion thermometer and thermoelectric temperature measurement.
3. To know about the principles of resistance and radiation thermometers.
4. To know the concept of composition analysis by various methods.
5. To know the measurement of pressure, vacuum, head and level, the principles and equipment used

Course Outcomes:

After studying this subject, student will be able to

1. Identify the characteristics of various instruments and the instrumentation process.
2. Recognize the relevant from expansion and thermoelectric thermometers.
3. Understand the working and use of various resistance and radiation pyrometers.
4. Apply the various techniques for composition analysis.
5. Interpret the pressure, head and level measuring devices.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3			1					1	1		1	1	1
	2	2			1					1	1		1	1	1
	3	2			1					1	1		1	1	1
	4	2			1					1	1		1	2	3
	5	2			1					1	1		1	1	1

UNIT I **12L + 3T**

Qualities of measurement: Measurement, functions and the elements of instruments, static and dynamic characteristics, dynamic response of first order and second order instruments.

Process Instrumentation: Recording instruments, types of charts indicating and signaling instruments, control center, different layouts, diametric control center.

UNIT II **12L+3T**

Expansion thermometers: Temperature scales, constant-volume gas thermometer, pressure spring thermometer, theory of volumetric and pressure thermometers, static accuracy of thermometer and comparison of pressure-spring thermometers.

Thermoelectric temperature measurement: Thermoelectricity, industrial thermocouples, thermocouple lead wires, thermal wells, response of thermocouples, the millivoltmeter, nullpotentiometer circuits.

UNIT III **12L + 3T**

Resistance Thermometers: Thermal coefficient of resistance, industrial resistance thermometer bulbs, resistance thermometer circuits, Wheatstone, Calender-Griffithus, double slide wire bridges, nullbridge resistance thermometers, deflectional resistance thermometers.

Radiation temperature measurement: Introduction, laws of radiation, blackbody conditions and devices, radiation receiving elements, radiation pyrometers, radiation receivers, photoelectric pyrometers and optical pyrometers.

UNIT IV **12L + 3T**

Composition analysis: Spectroscopic analysis, types, IR and UV absorption spectrometry, Beer – Lambert's law, mass spectrometry, gas analysis by thermal conductivity, analysis of moisture in gases (humidity), psychrometer, hygrometer and dew-point methods, pH measurement, gas chromatography, HPLC.

UNIT V **12L + 3T**

Measurement of pressure and vacuum: Pressure, vacuum and head, liquid column manometers, measuring elements for gauge pressure and vacuum, indicating elements for pressure gauges, electric pressure gauges, measurement of absolute pressure, measurement of pressure in corrosive fluids.

Measurement of Head and Level: Density and specific gravity, direct measurement of liquid level, pressure(level) measurement in open vessels, level measurement in pressure vessels, density measurement.

Text books:

1. Donald P.Eckman, "Industrial Instrumentation", Wiley Eastern Ltd., 2004.
2. R. Chatwal& Sham K. Ananad, "Instrumental methods of analysis", Gurudeep Himalaya publishing house (for topics of gas chromatography and HPLC).

Reference Books:

1. Principles of Industrial Instruments, Patrenabis, Tata McGraw Hill Inc,.

CHEMICAL ENGINEERING THERMODYNAMICS-I

CHE 225 **Credits: 4**

Instruction: 4 periods & 1 tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Course Objectives:

1. To provide knowledge on first law of thermodynamics and its importance.
2. To impart the relation between Pressure, Volume and Temperature.
3. To provide the relation between various heat effects and their temperature dependence.
4. To provide knowledge on second law of thermodynamics and its importance.
5. To impart knowledge on different balance equations and their usage.

Course Outcomes:

By the end of the course, student will be able to

1. Apply first law of thermodynamics to various systems.
2. Predict the PVT behavior using Virial equations.
3. Calculate heat effects on industrial reactions.
4. Apply second law of thermodynamics to various systems.
5. Develop balance equations on various equipments.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	1	1					1	1		1	2	3
	2	3	2	2	2					1	1		1	2	3
	3	3	2	2	2					1	1		1	2	3
	4	3	2	1	1					1	1		1	2	3
	5	3	2	1	1					1	1		1	2	3

UNIT I **12L + 3T**

The first law and other basic concepts: Joule’s experiments, internal energy, the first law of thermodynamics, thermodynamic state and path functions, enthalpy, steady-flow process, equilibrium, the phase rule, the reversible process, constant-V and constant-P processes, heat capacity.

UNIT II **12L + 3T**

Volumetric properties of pure fluids: PVT behavior of pure substances, virial equations, the ideal gas, application of the virial equations, cubic equations of state, generalized correlations for gases, generalized correlations for liquids, molecular theory of fluids, second virial coefficients from potential functions.

UNIT III **12L + 3T**

Heat effects: Sensible heat effects, internal energy of ideal gases, microscopic view, latent heats of pure substances, standard heat of reaction, standard of heat of formation, standard heat of combustion, temperature dependence of heat effects of industrial reactions.

UNIT IV **12L + 3T**

The Second Law of Thermodynamics: Statement of the second law, heat engines, thermodynamic temperature scales, thermodynamic temperature and ideal-gas scale, entropy, entropy changes of an ideal gas, mathematical statement of the second law, the third law of thermodynamics, entropy from the microscopic view point, Ideal work, lost work, Thermodynamic analysis of steady state flow process.

UNIT V **12L + 3T**

Thermodynamic Properties of Fluids: Property relations for homogeneous phases, residual properties, two-phase systems, thermodynamic diagrams, generalized property correlations for gases, Thermodynamics of flow processes, Equations of balance, duct flow of compressible fluids, turbines (expanders), compression processes.

Text Books:

1. J.M.Smith, H.C.Van Ness and M.M. Abbott, "Introduction to Chemical Engineering Thermodynamics" 6thed., McGraw-Hill International Editions, 2000.

Reference Books:

1. Y.V.C.Rao, "Chemical Engineering Thermodynamics", University Press (India) Ltd., Hyderabad, 1997.
2. B.F.Dodge , "Chemical Engineering Thermodynamics", McGraw-Hill Book Co.,
3. Michael M. Abbott and HendrickC.VanNess, "Schaum Outline of Theory and Problems of Thermodynamics'", 3rd ed., McGraw-Hill education, 2013.
4. K.V. Narayanan, "A Text book of Chemical Engineering Thermodynamics", PHI publications, 2009.

MOMENTUM TRANSFER LABORATORY

CHE226 **Credits: 2**

Practical/week: 3 Sessional Marks: 50

End Exam: 3 Hours End Exam Marks:50

Course Objectives:

1. To improve skills in measuring the flow rates.
2. To enable the students to familiarize with the different pumps.

Course Outcomes:

At the end of the course, the student will be able to:

1. Measure the flow rate by using different flow measuring devices.
2. Draw the characteristic curves of various pumps.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	3	3	3					3	2		1	2	3
	2	2	3	3	3					3	2		1	2	3

List of Experiments:

1. Identification of laminar and turbulent flows (Reynolds apparatus).
2. Measurement of point velocities (Pitot tube).
3. Verification of Bernoulli equation.
4. Calibration of rotameter.
5. Determination of orifice coefficient.
6. Determination of venturi coefficient.
7. Friction losses in fluid flow in pipes.
8. Pressure drop in a packed bed for different fluid velocities.
9. Pressure drop and void fraction in a fluidized bed.
10. To study the coefficient of contraction for a given open orifice.
11. To study the coefficient of discharge in a V – notch.
12. To study the characteristics of a centrifugal pump.

Text Book:

1. Warren L.McCabe and Julian C.Smith, “Unit Operations of Chemical Engineering”, 7th ed., McGraw Hill, 2005.

Reference Book:

1. Cengel and Cimbala, “Fundamentals of fluid mechanics”, 3rd ed., McGraw Hill Education, 2014.

MECHANICAL OPERATIONS LABORATORY

CHE 227 **Credits: 2**

Practical/week: 3 Sessional Marks: 50

End Exam: 3 Hours End Exam Marks:50

Course Objectives:

1. To understandingthe measuring of the average size of the given sample.
2. To enable the students to familiarize with the different crushing and grinding units and the concepts of equipment operation.
3. To understand the various separation techniques like screening, froth floatation and sedimentation.

Course Outcomes:
At the end of the course, the student will be able to:

1. Measure the average size of a given sample.
2. Operate crushing and grinding equipment.
3. Analyze various separation techniques for a given sample.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	3	3	3					3	2		1	2	3
	2	2	3	3	3					3	2		1	2	3
	3	2	3	3	3					3	2		1	2	3

List of Experiments:

1. To take a representative sample from a bulk by two methods, viz. Riffle and cone & quartering and to find out the average size (volume-surface mean diameter) of the samples.
2. To determine the time of grinding in a ball mill for producing a product with 80% passing a given screen.
3. To verify the laws of crushing using any size reduction equipment like jaw crusher, crushing rolls or ball mill and to find out the work Index {WI} of the material.
4. To compare open circuit and closed circuit grinding by means of a ball mill.

5. To determine the optimum time of sieving for a given sample of material.
6. To find the effectiveness of hand screening of a given sample by a given screen.
7. To find the screen effectiveness of a trommel.
8. To separate a mixture of coal into two fractions using sink and float method.
9. To separate a mixture of coal into two fractions using froth flotation technique.
10. To find the size analysis of a given fine sample using beaker decantation method.
11. To obtain batch sedimentation data and to calculate the minimum thickener area under given conditions.
12. To determine the collection efficiency of a cyclone separator.
13. To determine the settling velocities of various particle sizes and densities.

Text Book:

1. Warren L.McCabe and Julian C.Smith, “Unit Operations of Chemical Engineering”, 7th ed., McGraw Hill, 2005.

Reference Book:

1. Brown et al., “Unit Operations”, 1st ed., CBS Publisher, 2005.

OPEN ELECTIVE - I

INDUSTRIAL SAFETY AND HAZARD MANAGEMENT

CHE 311(A) **Credits:4**

Instruction :3 Lectures & 1 Tut/Week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks: 60

Prerequisites: Engineering chemistry

Course Objectives:

1. To know about Industrial safety programs and toxicology, Industrial laws , regulations and source models
2. To understand about fire and explosion, preventive methods, relief and its sizing methods
3. To analyse industrial hazards and its risk assessment.

Course Outcomes:

By the end of the course the students will be able to

1. Analyze the effect of release of toxic substances
2. Understand the industrial laws, regulations and source models.
3. Apply the methods of prevention of fire and explosions.
4. Understand the relief and its sizing methods.
5. Understand the methods of hazard identification and preventive measures.

CO –PO – PSO Matrix:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1															
	2															
	3															
	4															
	5															

SYLLABUS

UNIT I **9 L+ 3 T**

Introduction: Safety Programs, Engineering Ethics, Accident and Loss Statistics, Acceptable Risk, Public Perceptions, Nature of the Accident Process, Inherent Safety, Seven Significant Disasters.

Toxicology: Effect of Toxicants on Biological Organisms, Toxicological Studies, Dose versus Response, Models for Dose and Response Curves, Relative Toxicity, Threshold Limit Values, National Fire Protection Association (NFPA) Diamond.

UNIT II **9 L+ 3 T**

Industrial Hygiene: Government Laws and Regulations, OSHA: Process Safety Management, EPA: Risk Management Plan, DHS: Chemical Facility Anti-Terrorism Standards (CFATS) Industrial Hygiene: Anticipation and Identification, Evaluation, Control.

Source Models: Introduction to Source Models, Flow of Liquid through Holes, and Pipes, Flow of Gases or Vapors through Holes and Pipes, Flashing Liquids, Liquid Pool Evaporation or Boiling, Conservative Analysis

UNIT III **9 L+ 3 T**

Fires and Explosions: The Fire Triangle, Distinction between Fires and Explosions, Definitions, Flammability Characteristics of Liquids and Vapors, Limiting Oxygen Concentration and Inerting, Flammability Diagram, Ignition Energy , Autoignition , Auto-Oxidation , Adiabatic Compression, Ignition Sources, Sprays and Mists, Explosions

Concepts to Prevent Fires and Explosions: Inerting, Static Electricity and its Control, Explosion-Proof Equipment and Instruments, Ventilation, Sprinkler Systems, Miscellaneous Concepts for Preventing Fires and Explosions.

UNIT IV **9 L+ 3 T**

Introduction to Reliefs: Relief Concepts, Definitions, Location of Reliefs, Relief Types and Characteristics, Relief Scenarios, Data for Sizing Reliefs, Relief Systems.

Relief Sizing : Conventional Spring-Operated Reliefs in Liquid and in Vapor or Gas Services, Rupture Disc Reliefs in Liquid in Vapor or Gas Services, Two-Phase Flow during Runaway Reaction Relief , Pilot-Operated and Bucking-Pin Reliefs, Deflagration Venting for Dust and Vapor Explosions, Venting for Fires External to Process Vessels, Reliefs for Thermal Expansion of Process Fluids.

UNIT V **9 L+ 3 T**

Hazards Identification: Process Hazards Checklists, Hazards Surveys, Hazards and Operability Studies, Safety Reviews, Other Methods,

Risk Assessment: Review of Probability Theory, Event Trees, Fault Trees, QRA and LOPA

Text Book:

1. D.A. Crowl and J.F. Louvar, *Chemical Process Safety (Fundamentals with Applications)*, Prentice Hall, 2011.

Reference Books:

1. R.K. Sinnott, Coulson & Richardson's, *Chemical Engineering*, Vol. 6, Elsevier India, 2006.
2. Fawcett H.H. and W.S.Wood, *Safety and accident prevention in Chemical operations* 2ndediton John Wiley and Sons Inc. (1982).

CHEMICAL ENGINEERING THERMODYNAMICS-II

CHE 312 **Credits:4**

Instruction : 4 Lectures& 1 Tutorial/Week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks: 60

Prerequisites:

Physical Chemistry, Chemical Engineering Thermodynamics–Iand Chemical Process Calculations.

Course Objectives:

1. To provide basic knowledge on refrigeration, liquefaction and Phase equilibrium.
2. To familiarize with non-ideal solutions and fugacity concepts and calculations.
3. To acquaint knowledge on chemical reaction equilibria.

Course Outcomes:

By the end of the course, the student will be able to

1. Understand and apply refrigeration and liquefaction processes.
2. Identify the relations between phases in equilibrium.
3. Understand the concept of fugacity and apply it to non-ideal solutions.
4. Estimate the activity co-efficients.
5. Compute equilibrium constant for a chemical reaction.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	2	2					1	1		1	2	3
	2	3	2	2	2					1	1		1	2	3
	3	3	2	2	2					1	1		1	2	3
	4	3	2	3	3					1	1		1	2	3
	5	3	3	3	3					1	1		1	2	3

SYLLABUS

UNIT I **12 L + 3 T**

Refrigeration and Liquefaction:

Carnot Refrigerator, vapour compression cycle, choice of refrigerant, absorption refrigerant, heat pump , liquefaction process.

UNIT II **12L+3T**

Phase Equilibrium:

Nature of equilibrium, phase rule, Duhem's theorem, vapour-liquid equilibrium (VLE) qualitative behaviour, simple models for VLE, VLE by modified Raoult's law, VLE from k-value correlations, liquid-liquid equilibrium, vapour-liquid-liquid equilibrium, solid-liquid equilibrium, solid-vapourequilibrium.

UNIT III **12L+3T**

Thermodynamics of Solution–Theory:

Fundamental property relation, chemical potential and phase equilibria, partial properties, ideal gas mixtures, fugacity and fugacity coefficient – pure species, species in solution, generalized correlations for the fugacity coefficients, ideal solution, excess properties.

UNIT IV **9L + 3T**

Thermodynamics of Solution–Applications:

Liquid-phase properties from VLE data, models for the excess Gibbs Energy, property changes of mixing, heat effects of mixing processes.

UNIT V **15L+3T**

Chemical Reaction Equilibria:

Reaction coordinate,application of equilibrium criteria to chemical reactions, standard Gibbs energy change and the equilibrium constant, effect of temperature on the equilibrium constant, evaluation of equilibrium constants, relation of equilibrium constants to composition, equilibrium conversions for single reactions, phase rule and Duhem's theorem for reacting systems, multi reaction equilibria.

Text Book

1. J.M.Smith, H.C.Van Ness, M.M. Abbott and B. I. Bhatt, *Introduction to Chemical EngineeringThermodynamics*,7th ed., 2009, McGrawHill Education.

Reference Books

1. Y.V.C.Rao, *Chemical Engineering Thermodynamics*, 1997, University Press (India) Ltd.,Hyderabad.
2. Michael M. Abbott and HendrickC.VanNess, *Schaum'sOutlines of Theory and Problemsof Thermodynamics*, 3rd ed., 2013, McGrawHill education.
3. K.V. Narayanan, *A Text book of Chemical Engineering Thermodynamics*, 2013, PHIlearning.

HEAT TRANSFER

CHE313 **Credits:4**
Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Prerequisites:
Engineering Mathematics, Chemical Process Calculations.

Course Objectives:
1. To familiarize with three modes of heat transfer and to know about steady state and unsteady state heat conduction.
2. To know about heat transfer involving phase change and without phase change.
3. To familiarize the operation of different heat transfer equipments.
4. To understand the fundamental principles of radiation.
5. To impart knowledge on the principles of evaporation and evaporator design.

Course Outcomes:
By the end of the course, the student will be able to:
1. Implement the basic laws of conduction to steady state and unsteady state problems.
2. Predict convective heat transfer coefficients at various conditions.
3. Compute heat loss / gain due to radiation.
4. Classify various heat transfer equipments.
5. Determine the performance of different Evaporators.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	2	2					1	1		1	2	3
	2	3	2	2	2					1	1		1	2	3
	3	3	2	2	2					1	1		1	2	3
	4	1	2	1	1					1	1		1	2	3
	5	2	2	2	2					1	1		1	2	3

SYLLABUS

UNIT-I **12L+3 T**
Conduction:
Modes of heat flow: Conduction, convectionand radiation.
Conduction: Basic laws of conduction, thermal conductivity; steady-state conduction – compound resistances in series, heat flow through a cylinder; critical insulation thickness. unsteady-state conduction – one dimensional heat flow with constant surface temperature, heat flow with variable surface temperature, semi-infinite solid.

UNIT II **12L+3 T**

Convection:

Principles of heat flow in fluids – typical heat exchange equipment, countercurrent and parallel flows, energy balances, heat flux and heat transfer coefficients, LMTD.

Heat transfer to fluids without Phase change : Boundary layers, laminar flow heat transfer, heat transfer in turbulent flow, estimation of wall temperature, cross-sections other than circular, analogy between transfer of momentum and heat, heat transfer to liquid metals, heating and cooling of fluids outside tubes, natural convection.

Heat transfer to fluids with Phase change: heat transfer from condensing vapors, heat transfer to boiling liquids.

Unit III **12L+3 T**

Radiation:

Fundamental facts concerning radiation, emission of radiation, absorption of radiation by opaque solids, radiation between surfaces, radiation to semitransparent materials, combined heat transfer by conduction-convection-radiation.

UNITIV **12L+3 T**

Heat-exchange equipment:

General design of heat exchange equipment, shell and tube heat exchangers, plate-type exchangers, extended surface equipment, scraped-surface exchangers, condensers and vaporizers, heat transfer in agitated vessels, heat transfer in packed beds.

UNIT V **12L+3 T**

Evaporation:

Evaporation, types of evaporators, capacity and economy of evaporators, boiling point elevation and Duhring's rule, material and energy balances in single effect evaporator, multiple effect evaporators, methods of feeding and economy of multiple effect evaporators.

Text Book:

1. W. L. McCabe, J. C. Smith and P. Harriot, *Unit Operations of Chemical Engineering*, 7th Edition McGraw Hill International Edition, Singapore (2005).

Reference book:

1. D. Q. Kern, *Process Heat Transfer*, Tata McGraw Hill, New Delhi.
2. Holman. J.P., *Heat Transfer*, 9th Edition Tata McGraw Hill Book Co., New Delhi, 2008.
3. NecatiOzisik, *Heat Transfer: A Basic Approach*, Vol. 1, McGraw Hill, 1985.
4. Robert W. Serth, *Process Heat Transfer: Principles and Applications*, Academic Press, 2007.
5. J.P. Holman, *Heat Transfer*, 8th Edition, McGraw Hill, NewYork, 1997.

MASS TRANSFER-I

CHE 314 **Credits:4**

Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks: 60

Prerequisites: Introduction to Chemical Engineering, Chemical Process Calculations.

Course Objectives:

1. To understand the concepts of diffusion , stages, through mathematical equations
2. To understand the concepts of absorption and distillation
3. To expose the student to different types of equipment for Gas-Liquid Operations

Course Outcomes:

By the end of the course, the student will be able to:

1. Estimate the flux of molecules and diffusivity of gases, liquids and solids
2. Predict the mass transfer coefficients and know its importance
3. Design an absorption column
4. Generate VLE data and estimate the number of stages for a distillation column
5. Identify the equipment for different gas-liquid operations.

CO – PO – PSO Matrix:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	2	2					1	1	1	1	2	3
	2	3	2	2	2					1	1		1	2	3
	3	3	3	2	2					1	1	1	1	2	3
	4	3	3	2	2	1				1	1	1	1	2	3
	5	2	1	1	1					1	1		1	2	3

SYLLABUS

UNIT I **12L + 3T**

Introduction:

Classification of the mass transfer operations, molecular diffusion in fluids, binary solutions, Fick's law, equation of continuity, steady state molecular diffusion in fluids at rest and in laminar flow, Stefan's diffusion, estimation of diffusivity of gases and liquids, application of molecular diffusion,diffusion in solids.

UNIT II **12 L + 3T**

Mass Transfer Coefficients and Inter Phase Mass Transfer:

Concept of equilibrium, diffusion between phases, Theories of mass transfer, Mass, heat-, and momentumtransfer analogies, Mass transfer coefficients in laminar flow, Mass transfer coefficients in turbulent flow, Correlations for mass transfer coefficients in simple situations, Material balances in steady state co-current and counter current stage processes

UNIT III **12 L + 3T**

Absorption and Stripping:
Solubilitys of gases in liquids, two component systems, multi-component systems, ideal and non-ideal solutions, choice of solvent for absorption, single component absorption material balances, counter current multistage operations, dilute gas mixtures, non-isothermal operation, tray efficiency, HETP, HTU, NTU concepts for single operation absorption with chemical reaction.

UNIT IV **12 L + 3T**

Distillation:
Principles of VLE for binary systems, phase diagrams, relative volatility, ideal solutions, enthalpy concentration diagrams, flash vaporization, partial condensation, differential distillation, steam distillation, continuous distillation, McCabe-Thiele method, Ponchon-Savarit method, tray efficiencies, introduction to multi-component distillation, azeotropic and extractive distillations.

UNIT V **12 L + 3T**

Equipment for Gas - Liquid Operations:
Sparged vessels (Bubble columns), mechanically agitated vessels for single phase liquids and gas-liquid mixtures, Tray towers, sieve tray design for absorption (Qualitative treatment), venturi scrubbers, wetted wall towers, packed towers, Comparison between Tray towers and packed towers., design of packed humidifiers, dehumidifiers and cooling towers, spray chambers.

TEXT BOOK:

1. Treybal R.E., *Mass transfer operations*, 3rd Edition, McGraw Hill, 1980.

REFERENCES:

1. Cussler E. L., *Diffusion: Mass Transfer in fluid system*, Cambridge University Press, 2009.
2. Binay.K. Dutta, *Principles of Mass Transfer and Seperation Processes*, PHI Learning Pvt. Ltd, 2007.

CHEMICAL REACTION ENGINEERING – I

CHE 315 **Credits:4**

Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks: 60

Prerequisites:

Engineering Mathematics, Physical Chemistry, Chemical Process Calculations.

Course Objectives:

1. To learn principles of reaction engineering
2. To understand various mechanisms of chemical reactions
3. To gain knowledge on different reactors and their design

Course Outcomes:

By the end of the course, the student will be able to:

1. Predict various mechanisms for various reactions.
2. Analyse batch reactor data by various methods
3. Design various ideal reactors
4. Design various combinations of reactor systems
5. Quantify product distribution for multiple reactions

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3	3	3	1				1	1		1	2	3
	2	2	3	3	3	1				1	1		1	2	3
	3	2	1	1	1	1				1	1	1	1	2	3
	4	3	3	3	3	1				1	1	1	1	2	3
	5	3	2	2	2	1				1	1		1	2	3

SYLLABUS

UNITI **12 L + 3T**

Introduction:

Introduction and overview of chemical reaction engineering – Variables affecting a chemical reaction – Kinetics of homogeneous reactions – Concentration dependent term of rate equation – Elementary and nonelementary reactions – Temperature dependent term – Arrhenius law, activation energy, collision theory, transition state theory Searching for a mechanism.

UNITII **12 L + 3T**

Interpretation of Batch Reactor Data:
Methods of analysis, integral, differential and half life methods – Analysis of different types of reactions, irreversible and reversible – Variable volume reactor.

UNITIII **12 L + 3T**

Ideal Reactors:
Ideal reactors for a single reaction – Performance equations for batch, mixed flow and plug flow reactors – Space time, space velocity and mean residence time.

UNITIV **12 L + 3T**

Design of Multiple Reactors:

Design for single reactions – Size comparison of reactors – Multiple reactor systems – Recycle reactor

UNIT V **12 L + 3T**

Design of Reactors with Multiple Reactions:
Design for parallel and series reactions – Qualitative and quantitative discussion about product distribution.

Text Book:
1. Levenspiel, O., *Chemical Reaction Engineering*, 3rd Edition, John Wiley and Sons.

Reference Books:
1. J. M. Smith., *Chemical Engineering Kinetics*, 3rd edition.,Mc-Graw Hill, Inc.
2. H. Scott Fogler., *Elements of Chemical Reaction Engineering*, 5th edition., PHI Learning Private Ltd.

ELECTIVE-I

POLYMER TECHNOLOGY

CHE 316(A) **Credits:4**

Instruction : 4 Lectures& 1 Tutorial/Week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks: 60

Prerequisites:

Organic Chemistry

Course Objectives:

1. To provide basic knowledge on polymers and their classification.
2. To familiarize with chemistry and methods of polymerization.
3. To acquaint knowledge on processing equipment for polymerization.
4. To familiarize with the manufacturing of different polymer compounds.

Course Outcomes:

By the end of the course, the student will be able to

1. Classify polymers and determine molecular weight of a polymer.
2. Identify the kinetics of polymerization and importance of their properties.
3. Summarize the methods of polymerization.
4. Understand the principles and working of processing equipment.
5. Select the manufacturing process for a polymer compound.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	1	1	1					1	1		1	3	2
	2	2	1	1	1					1	1		1	3	2
	3	2	1	1	1			1		1	1		1	3	2
	4	2	1	1	1					1	1		1	3	2
	5	2	1	1	1					1	1		1	3	2

SYLLABUS

UNIT I **12 L + 3T**

Introductory Concepts and Fundamentals:

Definitions and concepts of plastics and polymers, comer, co-monomer, mesomer, co-polymer, functionality, visco-elasticity,Classification of polymers, methods of determining molecular weights of polymers: Methods based on colligative properties, Sedimentation velocity method, Sedimentation equilibrium method, Gel-chromatography method, Light scattering analysis method, End-group analysis method; Natural polymers: brief study of rubber, shellac, rosin, cellulose, proteins, Lignin.

UNITII **12 L + 3T**

Chemistry of Polymerization:

Elementary concepts of addition polymerization, condensation polymerization and co-polymerization, glass transition temperature of polymers, methods of determining glass transition temperature, degradation of polymers due to mechanical, hydrolytic, thermal and backbone effects, Relation of the mechanical, thermal, electrical, physical and chemical properties with the structure of the polymer.

UNITIII **12 L + 3T**

Methods of Polymerization:

Mass, solution, emulsion and suspension, role of the initiators, catalysts, inhibitors, solvents, fillers, reinforcing agents, stabilizers, plasticizers, lubricants, blowing agents, coupling agents, flame retardants, photo-degradants and bio-degradable on polymerization

UNITIV **12 L + 3T**

Processing Equipment:

Mixing, compounding, extrusion, calendaring, laminating, molding, compression, transfer, injection and blow molding.

UNIT V **12 L + 3T**

Manufacturing Processes of Addition Products:

Polyethylene (LDPE and HDPE), polypropylene, PVC and its copolymers, Polystyrene and its copolymers and PTFE (polytetraflouroethylene)

Manufacturing Processes of Condensation Products:

Polyesters: PMMA, PET, PF, UF and MFresins, epoxy resins.

Text Books:

1. R. Sinha, *Outlines of Polymer Technology: Manufacture of Polymers*,2004, Prentice Hall India Pvt. Ltd. (UNIT – I, II, III and V).
2. R. Sinha, *Outlines of Polymer Technology: Processing Polymers*,2004, Prentice Hall India Pvt. Ltd. (UNIT – IV).

Reference Books:

1. Billymeyer, F.W.Jr., *Textbook of Polymer Science*, 3rd edition, 2006, John Wiley & Sons
2. Anil Kumar. Gupta, R.K. *Fundamentals of PolymerEngineering*,2nd Ed, 2003, MarcelDekker.

ELECTIVE -I

FERTILIZER TECHNOLOGY

CHE316(B) **Credits:4**
Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Prerequisites:
Engineering Chemistry

Course Objectives:

- To understand the classification of fertilizers and the corresponding manufacturing processes for different fertilizers.

Course Outcomes:

At the end of the course, the student will be able to:

1. Classify the raw materials for fertilizer production and their importance.
2. Identify manufacturing processes of nitrogenous fertilizers.
3. Describe the production of N, P, K fertilizers.
4. Apply the knowledge of design of reactors for the manufacturing processes.
5. Acquaint with various methods of storage and handling of fertilizers.

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2								1	1		1	3	2
	2	2	1	1	1					1	1		1	3	2
	3	2	1	1	1					1	1		1	3	2
	4	2	1	1	1					1	1		1	3	2
	5	2	1	1	1			1		1	1		1	3	2

SYLLABUS

UNIT I **12 L + 3T**

Overview: Development of fertilizer industry, fertiliser production and consumption in India,nutrient contents of fertilizers,secondary nutrients,feedstock and raw materials for nitrogenous, phosphatic and potassic fertilizers.

UNIT II **12 L + 3T**

Nitrogenous Fertilizers: Ammonia from natural gas, associated gas, coke oven gas, naphtha, fuel oils and petroleum heavy stock, nitric acid, ammonium sulphate, ammonium nitrate, calcium ammonium nitrate, urea, ammonium chloride.

UNIT III **12 L + 3T**

PhosphaticFertilizers: Phosphoric acid, single super phosphate, triple superphosphate.

PotassicFertilizers: Potassium chloride, potassium sulphate.

Complex Fertilizers: Ammonium phosphate sulphate, MAP/ DAP, nitrophosphates, urea-ammonium phosphates.

Miscellaneous Fertilizers: Biofertilizers, liquid fertilizers, controlled release of fertilizers.

UNIT IV **12 L + 3T**

Design Aspects: **A**mmonia synthesis converters, urea autoclave, pipe reactors, prilling tower,retrofitting, upgrading and modernization of existing plants.

UNIT V **12 L + 3T**

Fertilizer Storage and Handling: Corrosion problems in fertilizer industries, fertilizer plants effluent treatment and disposal, case study of selected fertilizer plants with environmental aspects.

Text Books:

1. *Handbook of Fertilizer Technology*, Fertilizer Association of India, New delhi

Reference books:

1. *Production of Fertilizers (Booklets 1 to 8)*", European Fertilizer Manufacturers Association.
2. *Mineral Fertilizer Production and the Environment (Part 1 & 2)*, International Fertilizer Industry Association.
3. *Pollution Prevention and Abatement Handbook*, The world Bank Group

ELECTIVE -I

PAPER TECHNOLOGY

CHE 316(C) **Credits:4**
Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Prerequisites:
Engineering Chemistry

Course Objectives:
1. To have an insight on paper industry and its raw materials
2. To acquire knowledge on pulping processes
3. To gain acquaintance with manufacturing and testing techniques of paper.

Course Outcomes:
By the end of the course, the student will be able to:
1. Understand the importance of paper industry, types of paper and its uses
2. Know the types of raw materials and their preparation methods
3. Describe the various pulping processes
4. Describe the manufacturing processes of paper
5. Estimate and monitor the properties of paper

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2								1	1		1	3	2
	2	2	1	1	1					1	1		1	3	2
	3	2	1	1	1					1	1		1	3	2
	4	2	1	1	1					1	1		1	3	2
	5	2	1	1	1			1		1	1		1	3	2

SYLLABUS

UNIT I **12 L + 3T**
History, Types and Uses of Paper:
Importance of paper industry, historical background of paper making, development of paper industry in India, different types and uses of paper and paper products, composition, methods of making different types of paper and boards.

UNIT II **12 L + 3T**

Raw Materials and Their Preparation Methods:

Classification of fibres, characteristics and composition of some important vegetable fibers (hard woods, softwoods, bagasse, straws, rags and paper stock), wood preparation – pulp wood measurement, barking, chipping, screening and conveying of chips.

UNIT III **12 L + 3T**

Pulping Processes and Bleaching:

Mechanical pulping, alkaline pulping (Soda and Kraft), sulfite pulping, semi-chemical pulping, recovery of cooking chemicals from spent cooking liquors, bleaching agents, bleaching methods – single stage and multi stage bleaching

UNIT IV **12 L + 3T**

Manufacture of Paper:

Beating and refining, sizing and loading (filling), paper machines (Fourdrinier and Cylinder), making of paper – forming section, press section, dryer section, calendaring section.

UNIT V **12 L + 3T**

Testing of Paper:

Testing and evaluation of pulp, various properties of pulp and paper and their testing.

Text books:

1. K. P. Rao, *Pulp and paper technology*, 1st edition, 2003, CBS publishers

Reference Books:

1. Monica Ek, GöranGellerstedt, Gunnar Henriksson, Pulp and paper Chemistry and technology, volume 2, 2009, Walter de Gruyter GmbH & Co.

ELECTIVE -I

PHARMACEUTICAL TECHNOLOGY

CHE 316(D) **Credits:4**
Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Prerequisites:
Engineering Chemistry, Organic Chemistry

Course Objectives:
1. To know about various forms of drug development
2. To get acquaintance with semi solid and pharmaceutical aerosols
3. To have knowledge on pilot plant techniques

Course Outcomes:
By the end of the course, the student will be able to:
1. Formulate and develop tablets and capsules
2. Distinguish the process and equipment for monophasic and biphasic liquids
3. Describe the various production processes of Parenterals and Ophthalmic preparations
4. Differentiate the manufacturing processes and equipments for semi solids and pharmaceutical aerosols.
5. Analyse the pilot plant and scale up techniques

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2								1	1		1	3	2
	2	2	1	1	1					1	1		1	3	2
	3	2	1	1	1					1	1		1	3	2
	4	2	1	1	1					1	1		1	3	2
	5	2	1	1	1			1		1	1		1	3	2

SYLLABUS

UNIT I **12 L + 3T**
Formulation Development of Solid Dosage Forms:
Historical development of pharmaceutical industry, Advances in materials, process, equipment and production of tablets and hard and soft gelatin capsules.

UNIT II **12 L + 3T**

Formulation Development of Liquid Dosage Forms:

Advances in materials, process, equipment and formulation of monophasic liquid dosage forms and biphasic liquid dosage forms including multiple and micro emulsions.

UNIT III **12 L + 3T**

Formulation Development of Sterile Dosage Forms:

Parenterals: Advances in materials and production techniques, filling machines, sterilizers, and layout for production of parenterals.

Ophthalmic preparations: Advances in materials and production techniques, filling machines and sterilizersfor production of eye drops & eye Lotions.

UNIT IV **12 L + 3T**

Formulation Development of Semisolid Dosage Forms andPharmaceutical Aerosols

Semi-solids: study of the principles, formulation, manufacturing process and equipment for semisolid dosage forms.

Pharmaceutical Aerosols: study of the pharmaceutical propellents, principles, formulation, manufacturing process and filling equipments for Aerosols.

UNIT V **12 L + 3T**

Scale-Up Techniques Used In Pharmaceutical Manufacturing:

Pilot plant: Technology transfer from R&D to pilot plant to pilot scale considerations of steps involved with manufacture (design, facility, equipment selection) of tablets, capsules, suspensions, emulsions & semisolids.

Scale up: Importance, Scale up process-size reduction, mixing, blending, granulation, compression, coating involved in tablets, capsules & liquid-liquid mixing.

Text books

1. Roop K. Khar, S. P. Vyas, Farhan J. Ahmad and Gaurav K. Jain,*Lachman / Lieberman'sThe Theory and Practice of Industrial Pharmacy*, 4th edition, 2013, CBS.

References

1. Tripathi K.D., *Pharmacological Classification of Drugs With Doses And Preparations*, 5th edition, 2014, Jaypee Brothers Medical publishers.

ELECTIVE -I

SOAP AND DETERGENT TECHNOLOGY

CHE 316(E) **Credits:4**
Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Prerequisites:
Engineering Chemistry, Organic Chemistry

Course Objectives:

1. To know about soaps and detergents and their properties and applications
2. To have knowledge on manufacturing processes of soaps and detergents.
3. To get acquaintance with the environmental issues of soaps and detergent industry

Course Outcomes:
By the end of the course, the student will be able to:

1. Distinguish between soaps and detergents and know their applications
2. Understand the properties and additives to be used in soaps
3. Know the properties and additives to be used in detergents
4. Describe the manufacturing processes and equipments for soaps and detergents
5. Analyze the issues related to environment and improve biodegradable qualities

CO – PO – PSO Matrix:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2								1	1		1	3	2
	2	2	1	1	1					1	1		1	3	2
	3	2	1	1	1					1	1		1	3	2
	4	2	1	1	1					1	1		1	3	2
	5	2	1	1	1			1		1	1		1	3	2

SYLLABUS

UNIT I **12 L + 3T**

Introduction to Soaps and Detergents:

Present status of soap and detergent industries, Soap: Introduction, raw materials, classification and uses of soap, Detergents: Introduction, raw materials, classification and uses of detergent, Glycerin: Recovery of glycerin from fatty acid.

UNIT II **12 L + 3T**

Soap :

Kinetics and phase reactions in soap boiling, physico- chemical properties of soap solutions, plants and processes employed in soap manufacture, recovery of by-products, various households and industrial soaps, soap additives, metallic soaps, miscellaneous application of soap-based products, testing and evaluation of soaps.

UNIT III **12 L + 3T**

Detergents:

Chemistry and technology of synthetic detergents (anionic, cationic, non-ionic, and amphoteric), detergent additives, formulations and processing of detergent powders, tablets, liquid and pastes for household and industrial applications, biosurfactants and enzyme detergents, dry cleaning systems.

UNIT IV **12 L + 3T**

Manufacturing Processes:

Soap manufacturing: Cold process, continuous process, fatty acid neutralization,Detergent manufacturing: spray drying process, agglomeration, dry mixing

UNIT V **12 L + 3T**

Environmental Issues:

Bio-degradation of surfactants, eutrophication and ecological aspects, eco-friendly washing systems, natural saponin based surfactants, modern trends in detergent formulations, testing and evaluation of synthetic surfactants.

Text books

1. Woollatt E,*Manufacture of Soaps, Other Detergents and Glycerine*, 1984, Ellis Horwood Ltd publisher.

Reference Books:

1. Cavitch, Susan Miller, *The Natural Soap Book, 1994,* Storey Publishing

HEAT TRANSFER LABORATORY

CHE 317 **Credits: 2**
Instruction: 3 Practical hours /week Sessional Marks: 50
End Exam: 3 Hours End Exam Marks: 50

Prerequisites: Heat Transfer

Course Objectives:
1. To understand the basic heat transfer principles.
2. To impart knowledge in handling various heat transfer equipments.

Course Outcomes:
At the completion of the course, the student will be able to
1. Determine the heat transfer coefficients.
2. Operate various heat transfer equipments.

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	3	3					3	2		1	2	3
	2	3	3	3	3					3	2		1	2	3

List of Experiments:
1. Determination of total thermal resistance and thermal conductivity of composite wall.
2. Determination of the thermal conductivity of a metal rod.
3. Determination of the natural convective heat transfer coefficient for a vertical rod.
4. Determination of critical heat flux point for pool boiling of water.
5. Determination of forced convective heat transfer coefficient for air flowing through a pipe.
6. Determination of over-all heat transfer coefficient in double pipe heat exchanger.
7. Study of the temperature distribution along the length of a pin fin under natural and forced convection conditions
8. Estimation of unsteady state film heat transfer coefficient between the medium in which the body is cooled.
9. Determination of Stefan-Boltzmann constant.
10. Determination of emissivity of a given plate at various temperatures.
11. Determination of radiation constant of a given surface.
12. Study of electrical analog of heat conduction

Prescribed Books

1. W. L. McCabe, J. C. Smith and P. Harriot, *Unit Operations of Chemical Engineering*, 7th edition, 2005, McGraw-Hill.
2. Donald Q. Kern, *Process heat transfer*, 2008, Tata McGraw-Hill.

SOFT SKILLS LAB

CHE 318 **Credits : 02**
Instruction: 3 Practical hours /week Sessional Marks: 100

Prerequisites:
Basic English language skills-LSRW, English theory, English Language Lab.

Course Objectives:

1. To inculcate effective communication skills with appropriate body language.
2. To produce potent leaders, productive team players and effective individuals with proper professional ethics.
3. To enable students to make successful oral presentations using relevant content.
4. To train students for group discussions and job interviews which improves their employability skills.
5. To facilitate students the importance of setting realistic goals and achieving them using time management techniques.

Course Outcomes:
By the end of the course, the studentwill be able to:

1 Comprehend the core engineering subjects using effective verbal and nonverbal communication skills.
2 Present accurate and relevant information efficiently, using suitable material aids.
3 Work effectively as an individual as well in teams and emerge as responsible leaders with appropriate professional ethics.
4 Participate in group discussions and interviews using analytical and problem solving abilities, which enhance their employability skills.
5 Set time bound goals and realize them through strategic plans for successful career.

CO – PO – PSO Matrix:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**										3		1	1	1
	2				1						3	1	1	1	1
	3								3	3	1	1	1	1	1
	4				1					1	3		1	1	1
	5		1	1	1							1	2	1	1

SYLLABUS

UNITI **9 Lectures**

Art of Communication:

1. Definition of Communication
2. Types of Communication
3. Non-verbal Communication
4. Listening skills
5. Feed back

D.A. - Practice of proper hand shake, practice of different postures and gestures and activity on giving feedback

UNIT II **6 Lectures**

Presentation Skills:

1. Purpose
2. Effective presentation strategies
3. Analysis of audience
4. Preparing an outline of the presentation,
5. Audio –visual aids
6. Body language.

D.A. -Group presentation by each team

UNITIII **9Lectures**

Group Discussions: Introduction- as a part of selection process-guidelines for GD

1. Types of GD
2. Nature of topics of G.D
3. Roles to be played by participants in a GD
4. Evaluation process

D.A–Group discussions

UNIT IV **6Lectures**

Team Building and Leadership:

1. Importance of team work
2. Different stages of team formation
3. Good team vs. effective team
4. Team player and Team leader
5. Types of leadership
6. Decision making and negotiating skills

D.A-Decision making for a given situation

UNIT V **3Lectures**

Time- Management:

1. Importance of time-management
2. Time-Management models
3. Prioritization
4. The art of saying 'No'
5. Identifying Time Wasters

D.A -Time- Bound activities devised by the facilitator

UNIT VI

Goal-Setting: **3Lectures**

1. Different type of Goals (Immediate and Short term)
2. 'SMART' Goals
3. Strategies to achieve goals

D.A - Prepare a chart of immediate, short term and long term goals

UNIT VI:

Job- Interviews **9Lectures**

1. Preparing Resumes and C.V's
2. Preparing for the interview
3. FAQ's (Integrity, Stress management, Close- Ask questions)

D.A –Mock interviews

REFERENCE BOOKS:

1. Sanjay Kumar and Pushpalata, *Communication Skills* ,Oxford University Press , 2011.
2. Allan Pease, *Body Language*, Sheldon Press,1997.
3. John A. Kline and BhavnaBhalla, *Speaking Effectively; Achieving Excellence in Presentations*, Pearson publication, 2013.
4. Marc Mancini, *Time Management*, Tata McGraw Hill publishing Comp.Ltd.,2003.
5. Peter Veruki, *The 250 Job Interview Questions*,Adams Media Corporation Avon, Massachusetts,1999.

Quantitative Aptitude I

3/4 B. Tech, Semester 1

Course Objectives:

- To categorize, apply and use thought process to distinguish between concepts of Quantitative methods.
- To prepare and explain the fundamentals related to various possibilities and probabilities related to quantitative aptitude.
- Tocriticallyevaluatenumerouspossibilitiesrelatedtopuzzles.

Course Outcomes:

The student will be able to

- Use their logical thinking and analytical abilities to solve Quantitative aptitude questions from company specific and other competitive tests.
- Solve questions related to Time and distance and time and work etc. from company specific and other competitive tests.
- Understandandsolvepuzzlerelatedquestionsfromspecificandothercompetitivetests

UNIT I **6 Periods**

Numerical computation:

Applications based on Numbers, Chain Rule, Ratio Proportion

UNIT II ***6 Periods***

Numerical estimation - I

Applications Based on Time and work, Time and Distance

UNIT III ***4 Periods***

Numerical estimation – II

Applications based on Percentages, Profit Loss and Discount, Simple interest and Compound Interest Partnerships, Shares and dividends

UNIT IV ***4 Periods***

Data interpretation

Data interpretation related to Averages, Mixtures and allegations, Bar charts, Pie charts, Venn diagrams

UNIT V ***4 Periods***

Application to industry in Geometry and Mensuration

Books for practice

1. Quantitative aptitude by R S Agarwal, S Chand Publications
2. Verbal and non verbal Reasoning by RS Agarwal from S Chand publications

References

1. Barron‟s by Sharon Welner Green and IraK Wolf (Galgotia Publications pvt. Ltd.)
2. Quantitative Aptitude by U Mohan Rao Scitech publications
3. Quantitative Aptitude by Arun Sharma McGrawhill publications
4. Quantitative Aptitude by Ananta Asisha Arihant publications
5. Quantitative Aptitude by Abhijit Guha
6. Quantitative Aptitude by Pearson publications
7. Material from „IMS, Career Launcher and Time Institutes for Competitive exams.
8. Elementary and Higher Algebra by H. S. Hall an S. R. Knight

Verbal Ability I
3/4 B. Tech, Semester 1

Course Objectives

1. To categorize and explain various principles of grammar in order to help students to minimize errors in English

2. To critically evaluate a given reading material for improving ones' reading skills and comprehension

3. To illustrate and explain the intricacies and nuances involved in choosing responses to the questions asked in an examination, reading between the lines and beyond the lines

4. To describe and use different idiomatic expressions, phrasal verbs and rules of punctuation, in professional contexts

Course Outcomes

1. Detect errors of grammar and usage in a given sentence/text and rectify them by making appropriate changes

2. Solve questions based on critical reasoning

3. Analyze reading passages and quickly find out the correct responses to questions asked by using reading skills like skimming, scanning, reading between the lines, etc.

4. To use idiomatic expressions in writing and speaking and to solve questions based on them.

Unit 1 **8 Periods**

Grammar and Structure

Parts of Speech (with special emphasis on Prepositions, Conjunctions and Pronouns) – Articles – Tenses – Phrases and Clauses - Subject Verb Agreement – Conditional Clauses – Phrasal Verbs – Degrees of Comparison – Modifiers (Misplaced and Dangling Modifiers) – Determiners – Parallelism – Word Order – Subjunctive Mood – Redundancy – Error Detection and Sentence Correction

Unit – 2 **6 Periods**

Reading Comprehension

Structure of a Reading Passage – Idea Organization Styles – Style and Tone – Skimming and Scanning – Techniques for Fast and Active Reading –Different Types of Questions and Techniques for Answering Them – Reading between the Lines and Reading beyond the Lines – Theme Detection – Identifying Central Idea of the Passage – Using Context to Answer Vocabulary Based Questions

Unit –3 **6 Periods**

Critical Reasoning

Understanding Critical Reasoning – Basic Terminology in CR (Premise, Assumption, Inference and Conclusion) – Sequencing of Sentences (Rearranging Jumbled Paragraphs) – Cloze Passages

Unit – 4 **4 Periods**

Usage

Sentence completion techniques (with emphasis on signpost words), idiomatic language, structure and coherence in paragraph, punctuation, run-on errors, sentence fragments, comma splices

MASS TRANSFER-II

CHE 321 **Credits:4**

Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks: 60

Prerequisites:

Mass Transfer-I

Course Objectives:

1. To understand liquid-liquid operations
2. To understand the solid-liquid, solid-gas operations
3. To understand the membrane separation processes

Course Outcomes:

By the end of the course, the student will be able to

1. Plot Ternary liquid equilibrium and process design of extractors.
2. Classify different leaching equipments and compute material balance.
3. Understand adsorption isotherms and evaluate the processdesign aspects of adsorption column.
4. Estimate total time for drying operation and understand different types of drying equipment.
5. Identify the importance of crystallization and membrane separation processes.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	2	2					1	1		1	2	3
	2	3	2	2	2					1	1		1	2	3
	3	3	2	2	2			1		1	1		1	2	3
	4	3	2	2	2					1	1		1	2	3
	5	3	1	1	1			1		1	1		1	2	3

SYLLABUS

UNIT I **12 L + 3T**

Liquid-Liquid Extraction: Fields of applications of ternary liquid systems, triangular and solvent free coordinate systems, choice of solvent selectivity, extraction with insoluble and partially soluble systems, single stage and multistage cross current and counter current extraction without reflux, multistage counter current extraction with reflux, continuous contact extraction (packed beds), equipment for liquid-liquid extraction operation.

UNIT II **12 L+ 3 T**

Leaching: Fields of applications, preparation of solid for leaching, types of leaching, leaching equilibrium, single stage and multi stage leaching calculations, constant under flow conditions, Unsteady state operation equipment – percolation tanks, shank system, filter press leaching, agitated vessels, steady state operation equipment- agitated vessels, thickeners, CCD, classifiers, leaching of vegetable seeds.

UNIT III **12 L+ 3 T**

Adsorption: Theories of adsorption, recovery of solvent vapors, industrial adsorbents, adsorption equilibria and isotherms. single and multi- stage operations, unsteady state adsorption, and equipment for stage-wise and continuous contact.

UNIT IV **12 L + 3T**

Drying: Moisture contents of solids, equilibrium moisture content, bound and unbound moisture, drying conditions – rate of batch drying under constant drying conditions, mechanism of batch drying, drying time, thorough circulation drying, batch and continuous drying equipment, design of continuous counter current dryer.

UNIT V **12 L+ 3 T**

Crystallization and Membrane Separation Processes:
Crystallization: Equipment and analytical methods, factors governing nucleation and crystal growth rates, controlled rate of crystals, incorporation of principles into the design of the equipment
Membrane separation processes: Principles of membrane separations, separation of gases and liquids, dialysis, membranes for liquid extraction, pervaporation, reverse osmosis.

Case Studies for all mass transfer operations with interdisciplinary approach (for internal assessment only)

TEXT BOOK:

1. Treybal R.E., *Mass transfer operations*, 3rd Edition, McGraw Hill, 1980.

REFERENCES:

1. Cussler E. L., *Diffusion: Mass Transfer in fluid system*, Cambridge University Press, 2009.
2. Binay.K. Dutta, *Principles of Mass Transfer and Seperation Processes*, PHI Learning Pvt. Ltd, 2007.

CHEMICAL REACTION ENGINEERING – II

CHE 322 | **Credits:4**

Instruction : 4 Lectures& 1 Tut/Week | Sessional Marks : 40

End Exam : 3 Hours | End Exam Marks: 60

Prerequisites:

Chemical Reaction Engineering-I

Course Objectives:

1. To have an overview of temperature and pressure effects on chemical reactions
2. To analyse different non-ideal reactors
3. To interpret and design solid catalysed and fluid-fluid reactors

Course Outcomes:

By the end of the course, the student will be able to:

1. Analyze the temperature and pressure effects of chemical reactions
2. Distinguish between ideal and non-ideal reactors
3. Characterize the catalyst by knowing their properties
4. Design solid-catalyst reactors
5. Formulate the mechanisms for solid-fluid and fluid-fluid reactions

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	2	2	2					1	1		1	2	3
	2	3	2	2	2					1	1		1	2	3
	3	3	1	1	1					1	1		1	2	3
	4	3	3	3	3					1	1		1	2	3
	5	3	3	3	3					1	1		1	2	3

SYLLABUS

UNIT I **12 L+ 3 T**

Temperature and Pressure Effects:

Heats of reaction and temperature – Equilibrium constants from thermodynamics – Equilibrium conversion – General graphical design procedure – Optimum temperature progression – Adiabatic operations.

UNIT II **12 L+ 3 T**

Non Ideal Flow:

Basics of non-ideal flow: C,E and F curves – Conversion in non ideal flow reactors – Dispersion model – Tanks-in-series model.

UNIT III **12 L+ 3 T**

Heterogeneous Catalysis:

Physical adsorption – Chemisorption – Catalyst properties – Estimation of surface area, pore volume and porosity – Catalyst preparation – Catalyst poisons – Catalytic deactivation.

UNIT IV **12 L+ 3 T**

Solid Catalysed Reactions:

Rate equations – Pore diffusion combined with surface kinetics – Thiele modulus – Effectiveness factor – Performance equations for reactions containing porous catalyst particles – Experimental methods for finding rates – Determining controlling resistances.

UNIT V **12 L+ 3 T**

Non-Catalytic Systems:

Design of fluid-fluid reactors – Factors to consider in selecting a contractor – Various contractors and contacting patterns for G/L reactions. Design of fluid particle reactions – Progressive Conversion Model (PCM), Shrinking Core Model (SCM) – Comparison – Controlling mechanisms – Determination of rate controlling step.

Text Book:

1. Levenspiel O. *Chemical Reaction Engineering*, 3rd Edition, John Wiley & Sons.

Reference books:

1. J. M. Smith., *Chemical Engineering Kinetics*, 3rd edition.,Mc-Graw Hill, Inc.
2. H. Scott Fogler., *Elements of Chemical Reaction Engineering*, 5th edition., PHI Learning Private Ltd.

MATERIAL SCIENCE AND ENGINEERING

CHE 323	**Credits:4**
Instruction : 4 Lectures& 1 Tutorial/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites:

Engineering Physics,Engineering Chemistry, Mechanical Engineering and Strength of Materials

Course Objectives:

1. To provide an understanding on various crystal structures and their determination
2. To impart knowledge on various imperfections in crystals and their importance.
3. To furnish ability on mechanical properties of materials and failure mechanisms
4. To cater enlightenment on composite materials in present day scenario
5. To acquire knowledge on phase diagrams for alloy systems

Course Outcomes:

By the end of the course, the student will be able to

1. Identify and depict the crystal structure and their properties based on the structure.
2. Quantify the imperfections in a crystal.
3. Analyse the mechanical properties of engineering materials, draw the stress – strain diagrams.
4. Classify composite materials and their importance in engineering design and determine the type of fracture mechanism.
5. Outline heat treatment process to obtain required mechanical properties for a given alloy.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1	1	1					1	1		1	2	3
	2	3	1	1	1					1	1		1	2	3
	3	3	1	1	1					1	1		1	2	3
	4	3	1	1	1					1	1		1	2	3
	5	3	1	1	1					1	1		1	2	3

SYLLABUS

UNIT I **12 L + 3T**

Atomic Structure and Inter Atomic Bonding:

Electrons in atoms:Rutherford model, Bohr atomic model, wave mechanical model; bonding forces and energies, primary interatomic bonds: ionic bonding, covalent bonding, metallic bonding; secondary bonding: Van der Waals bonding, Hydrogen bonding.

Structure of Crystalline Solids:

Unit cells, metallic crystal structures, density computations, crystal systems, crystallographic points, directions and planes, X-ray diffraction and Bragg's law.

UNITII **12 L + 3T**

Point Imperfections:

Vacancy, Interstitial, Frenkel and Schotkey defects, Line imperfections:Burgers circuit and Burgers vector, dislocation reaction,edge, screw and mixed dislocations; surface defects: grains grain boundary and stacking faults; Volume defects: introduction to precipitates, dispersants, inclusions and voids.

UNIT III **12 L+ 3 T**

Mechanical Properties of Materials:

Concepts of stress and strain, elastic compliances, stress-strain diagrams for ductile and brittle materials, elastic behaviour, plastic deformation, hardness: Rockwell hardness test, Brinell hardness test , Knoop and Vickers hardness test; critical resolved shear stress (CRSS), cold working and hot working, anelasticity, viscoelasticity, viscoelastic models.

UNIT IV **12 L + 3T**

Fracture Mechanism:

Ductile fracture, brittle fracture, creep mechanism and fatigue mechanism.

Composite Materials:

Classification and applications: particulate reinforced composites, fiber reinforced composites and structural composites.

UNIT V **12 L + 3T**

Phase Diagrams and Transformations:

Phase rule, unary, binary phase diagrams, thermal equilibrium diagrams, eutectic and eutectic phase diagrams, peritectic and peritectic phase diagrams,Cd-Bi, Pb-Sn, Cu-Ni, Ag-Cu, Fe-C or Fe-Fe_3C-phase transformations, time temperature, transformation curves for eutectoid steels, plain carbon steels, effect of addition of alloying elements on the properties of steels, types of steels used in chemical industries.

Text Book

1. William D. Callister Jr., *Material Science and Engineering*,7th ed., 2007, John Wiley & Sons.

Reference Books

1. V. Raghavan, *Materials Science & Engineering*,5th edition, 2015, Prentice Hall of India Ltd, New Delhi

2. ManasChanda, *Science of Engineering Materials*, Vols.1-3, McMillan Companyof India, Delhi.

CHEMICAL TECHNOLOGY

CHE 324 **Credits:4**
Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Prerequisites:
Engineering chemistry, Organic chemistry.

Course Objectives:
1. To know about the inorganic chemical manufacturing processes of sulphur, nitrogen phosphorus, chloro alkali and cement industries.
2. To understand organic chemical manufacturing processes of coal, petroleum, vegetable oils, soaps, paints,pulp, cane sugar andpolymerization industries.

Course Outcomes:
By the end of the course, the student will be able to:
1. Outline the manufacturing of sulphur and nitrogen product industries.
2. Describe the manufacturing of phosphoric acid, chloro-alkali and cement industries.
3. Understand the manufacture of coal chemicals and petroleum products.
4. Acquire the knowledge on extraction of vegetable oils and manufacture of paints and varnishes.
5. Describe the manufacture of pulp, cane sugar and polymerization products

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2					1	1		1	1		1	2	3
	2	2					1	1		1	1		1	2	3
	3	2					1	1		1	1		1	2	3
	4	2					1	1		1	1		1	2	3
	5	2					1	1		1	1		1	2	3

SYLLABUS

UNIT I **12 L+ 3 T**
Sulphurand Sulphuric Acid: Sources of sulphur-sulphuric acid, different processes of manufacturing-contact process, DCDA process for sulphuric acid manufacture.
Nitrogen industries: Manufacture of ammonia, nitric acid and urea.

UNIT II **12 L+ 3 T**
Phosphorous and Phosphoric Acid: Methods for production of phosphoric acid.
Chloro-Alkali Industries: - Manufacture of soda ash, caustic soda and chlorine.
Cement: Types of cement, manufacture of ordinary portland cement [OPC], slag cement.

UNITIII **12 L+ 3 T**

Coal And Coal Chemicals: Types of coal, different uses, distillation of coal, treatment of products, low and high temperature carbonization of coal, coal tar distillation.

Petroleum: Origin, classification, composition of crude oil, production of crude oil, distillation of crude petroleum, refining-methods, uses of products.

UNITIV **12 L+ 3 T**

Vegetable Oils: Extraction, purification, hydrogenation of oils.Manufacture of fatty acids and soaps, detergents- classification and manufacture.

Paints and Varnishes: Constituents of paints, manufacturing procedures, varnishes.

UNITV **12 L+ 3 T**

Pulp and Paper: Kraft process and sulphite process, production of paper,

Cane Sugar: Refining, manufacture of sucrose, production of ethanol by fermentation. Manufacture of penicillin.

Polymerisation: Differentmethods, manufacture of polyethylene, phenol formaldehyde, SBR, 6-nylon, 6,6-nylon,.

Text book:

1. GopalaRao, M. and Marshall Sitting, *Dryden's out lines of chemical Technology*, 3rd edition, East West Press Pvt.Ltd.

Reference books:

1. Austin,G.T, Shreve's, *Chemical Process Industries,*5th edition, Mcgraw Hill Publishers
2. Kirk R .E. and Othmer D. F., *Encyclopedia of Chemical Technology, 4th edition*, Inter Science.

ELECTIVE-II

PETROCHEMICALS

CHE 325(A) **Credits:4**

Instruction : 4Lectures& 1 Tut/Week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks: 60

Prerequisites: Organic Chemistry

Course Objectives:

1. To make a thorough understanding of the availability of petroleum feed stocks for petrochemicals.
2. To understand the methods to produce various petrochemicals fromC_2, C_3, C_4 and higher carbon atoms.
3. To methodolically furnish the conversion of petroleum feedstocks to chemicals and intermediates.

Course Outcomes:

By the end of the course, the student will be able to

1. Understand petrochemical industry feedstocks, various chemicals produced from methane.
2. Describe the production of different chemicals from C_2 carbon atoms
3. Outline the production of different chemicals from C_3, C_4 and higher carbon atoms and production of various polymers.
4. Acquire the knowledge on production of petroleum aromatics
5. Describe the production of different intermediate chemicals, synthetic fibres, rubber and synthetic detergents.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2								1	1		1	3	2
	2	2								1	1		1	3	2
	3	2								1	1		1	3	2
	4	2								1	1		1	3	2
	5	2								1	1		1	3	2

SYLLABUS

UNIT I **12 L+ 3 T**

Petrochemical Industry-Feed Stocks: Petrochemical industry in India, feed stocks for petrochemicals.Chemicals from methane: Introduction, production of methanol, formaldehyde, ethylene glycol, PTFE, methylamines.

UNIT II **12L+ 3T**

Chemicals From C2 Carbon Atoms:ethylene production, vinyl chloride monomer, vinylacetate monomer, ethylene oxide, ethylene glycol, acetylene, acetaldehyde from Acetylene.

UNIT III ` **12L + 3T**

Chemicals From C3,C4 and Higher Carbon Atoms: Isopropylalcohol, acrylonitrile, acrylic acid, phenol, bisphenol-A, iso and n-butanol, methyltertbutylether, methacrylic acid, malic anhydride.

Polymers of Olefins: Polymer structure, methods of polymerization, high density polyethylene (HDPE), low density polyethylene (LDPE), polypropylene, polyvinylchloride, polystyrene.

UNIT IV **12L + 3T**

Petroleum Aromatics: Aniline, styrene, benzoic acid, caprolactum, terephthalic acid, phthalic anhydride.

UNIT V ` **12 L+ 3 T**

Synthetic Fibres and Rubber: Production techniques of synthetic fibres, production of polyester, nylon-6,6, nylon- 6, acrylic fibers. Synthetic rubber: Styrene butadiene rubber (SBR), butyl rubber, synthesis of polyurethane.

Plastics: Phenol formaldehyde resins, urea formaldehyde resins, polycarbonates.

Synthetic detergents: Classification of detergents, general manufacture of sulphonates, keryl benzene sulphonate (Surf).

TEXT BOOK:

1. B.K.BhaskaraRao, *A Text book on Petrochemicals*, 3rd Edition, Khanna Publishers, New Delhi.

REFERENCE BOOKS:

1. A.Chanvel and G. Lefebvre, *Petrochemical processes*, Vol.2, 2nd Edition, Gulf publishing company.
2. George T. Austin, *Shreve's chemical process industries*, 5th edition, McGraw Hill Publishers.
3. GopalaRao, M. and Marshall Sitting,*Dryden's out lines of chemical Technology*,3rd edition, East West Press Pvt.Ltd.

ELECTIVE-II

COMPUTER APPLICATIONS IN CHEMICAL ENGINEERING

CHE 325(B) **Credits:4**

Instruction : 4Lectures& 1 Tut/Week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks: 60

Prerequisites: Engineering Mathematics, Chemical Process Calculations

Course Objectives:

1. To provide knowledge of matrix and numerical mathematics for direct numerical analysis.
2. To provide knowledge of numerical integration and differential equations for iterative numerical analysis.
3. To introduce the concept of computer simulation for engineering process.
4. To provide the basic procedure to simulate elementary chemical engineering equipment.
5. To impart the knowledge of performing optimization and sensitivity analysis of elementary chemical engineering equipment.

Course Outcomes:

By the end of this course students will be able to

1. Perform basic matrix operations and apply direct numerical methods.
2. Perform basic iterative numerical analysis.
3. Understand the need for computer simulation in chemical engineering and its applications.
4. Simulate elementary chemical engineering equipment using ASPEN Plus.
5. Analyze equipment for sensitivity and optimization using ASPEN Plus.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	2	2					1	1		1	3	2
	2	3	2	2	2					1	1		1	3	2
	3	3	2	2	2	2				1	1		2	3	2
	4	3	2	2	2	2				1	1		2	3	2
	5	3	2	2	2	2				1	1		2	3	2

SYLLABUS

UNIT I **12 L+ 3 T**

Matrix Algebra And Numerical Methods:

Introduction to basic matrix and special matrix – triangular, symmetrical and diagonal, elementary operations for matrix, Gaussian elimination method, Jacobi method .

UNIT II **12 L + 3T**

Numerical Integration and Differentiation:

Basics of numerical differentiation and integration, Newton-Raphson method, Trapezoidal rule, Simpson's 1/3rd and 1/8th rules, Runga-Kutta method, Taylor series, Euler's method.

UNIT III ` **12 L + 3T**

Introduction to Computer Simulation:

Mathematical modelling, types of modular approaches, process flow diagrams, information flow diagrams, process flow sheets, conversion of information diagrams into process flow sheets, information matrices – process, stream connection, incidence and adjacency, simulation software for chemical engineering processes.

UNIT IV **12 L+ 3 T**

Simulation of Basic Equipment Using ASPEN Plus:

Steady state simulation of pumps, simulation of flash columns and heat exchangers, simulation binary distillation columns, simulation of reactors.

UNIT V ` **12 L+ 3 T**

Steady State Optimization and Sensitivity AnalysisUsing ASPEN Plus:

Steady state optimization of pumps, flash columns and heat exchangers, steady state sensitivity analysis of pumps, flash columns and heat exchangers.

TEXT BOOKS:

1. Gupta S.K., *Numerical Methods for Engineers*, 2003, New age international.
2. Jana A.K., *Process Simulation and Control using ASPEN*, 2nd edition, 2012, Prentice-Hall.

REFERENCE BOOKS:

1. Steven C Chapra. Raymond P. Canale, *Numerical Methods for Engineers with Personal Computer Applications*, 2nd edition, 1990, Mc-Graw Hill.
2. Roger G. E. Franks *Modeling and Simulation in Chemical Engineering*, 1972, John Wiley and Sons.

WEB RESOURCES:

1. http://nptel.ac.in/courses/103106074/
2. https://ocw.mit.edu/courses/materials-sciences-and-engineering/3-021j-introduction-to-modeling-and-simulation-spring-2012/part-i-lectures-readings/

ELECTIVE-II

MEMBRANE TECHNOLOGY

CHE 325(C) **Credits:4**

Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks: 60

Prerequisites:

Introduction to Chemical Engineering

Course Objectives:

- To acquaint with the new technologies and modelling approach of membrane technology and their application in real practical problems.

Course Outcomes:

By the end of the course, the student will be able to

1. Understand the principles and properties of membrane materials.
2. Know the techniques of preparation of synthetic membranes.
3. Understand the transport phenomena in membranes.
4. Comprehend the mechanisms for membrane processes.
5. Gain the knowledge of various membrane configurations and about membrane fouling.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1							1	1		1	3	2
	2	3	1	1	1					1	1		1	3	2
	3	3	2	1	1					1	1		1	3	2
	4	3	2	1	1					1	1		1	3	2
	5	3	2	1	1					1	1		1	3	2

SYLLABUS

UNIT I **12 L+ 3 T**

Introduction: Definition of membrane, membrane types,membrane separation processes, advantages and limitations of membrane technology compared to other separation processes, membrane materials and properties.

UNIT II **12 L+ 3 T**

Preparation of Synthetic Membranes: Phase inversion membranes, preparation techniques for immersion precipitation, synthesis of asymmetric and composite membranes, influence of various parameters on membrane morphology and synthesis of inorganic membranes.

UNIT III **12 L+ 3 T**

Transport In Membranes: Introduction, driving forces, transport through porous membranes, transport through non-porous membranes, transport through ion-exchange membranes.

UNIT IV **12 L+ 3 T**

Membrane Processes: Pressure driven membrane processes, concentration as driving force, electrically driven membrane processes.

UNIT V **12 L+ 3 T**

Modules, Polarisation Phenomena and Fouling: Introduction, membrane modules, comparison of the module configuration**,** concentration polarization, membrane fouling.

Text Books:

1. Mulder M,*Basic Principles of Membrane Technology*, Kluwer Academic Publishers, London, 1996.
2. KaushikNath, *Membrane Separation Processes*, Prentice-Hall Publications, New Delhi, 2008.

Reference books:

1. MunirCheryan,*Ultrafiltration and Microfiltration*, 2ndedition, Technomic Publishing Co(1998).
2. J.D.Seader and Ernest J. Henley , *Separation process principles*,2ndedition, Wiley India
3. R. E. Kesting,*Synthetic Polymeric membranes*, , 2nd edition, McGraw Hill (1985)
4. Richard W. Baker, *Membrane Technology and Research*, Inc. (MTR), Newark, California, USA, 2004.

ELECTIVE-II
CATALYSIS

CHE 325 (D) **Credits:4**
Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Prerequisites:
Fundamentals of Chemical Reaction Engineering

Course Objectives:
1. To understand the fundamentals of catalysts
2. To have a knowledge of various catalytic reactors
3. To have an awareness of biocatalysts and bioreactors

Course Outcomes:
By the end of the course, the student will be able to:
1. Know different types of catalysts and determination of their characteristic properties
2. Understand the mechanism and determine the rate limiting step
3. Design various industrial catalytic reactors
4. Acquire knowledge on catalyst deactivation and methods of regeneration
5. Correlate catalysis to biosystems

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1							1	1		1	3	2
	2	3	2	2	1					1	1		1	3	2
	3	3	2	2	1					1	1		1	3	2
	4	3	2	2	1					1	1		1	3	2
	5	3	2	2	1					1	1		1	3	2s

SYLLABUS

UNITI **12 L+ 3 T**
Introduction to Catalysis:
Catalyst properties, homogeneous and heterogeneous catalysts, catalyst preparation, estimation of catalyst properties, determination of surface area, porosity, pore volume, solid density, different types of adsorption isotherms.

UNIT II **12 L+ 3 T**

Catalyst Mechanisms:

Steps in a catalytic reactions, synthesizing rate law, mechanism, rate limiting step

UNIT III **12 L+ 3 T**

Design Of Catalytic Reactors:

Design equations, heterogeneous data analysis: deducing, finding mechanism and evaluation of rate law parameters, chemical vapour deposition.

UNIT IV **12 L+ 3 T**

Catalyst Deactivation:

Types of catalyst deactivation, catalyst poisons, catalyst inhibitors, temperature time trajectories, moving bed reactors, determining the order of deactivation, catalyst regeneration

UNIT V **12 L+ 3 T**

Biocatalysis:

Enzymes, mechanism of enzyme-substrate reactions, immobilized enzyme kinetics, production and applications of various biocatalysts

Text books:

1. J. M. Smith., *Chemical Engineering Kinetics*, 3rd edition., Mc-Graw Hill, Inc. (**Unit-I**)

2. H. Scott Fogler., *Elements of Chemical Reaction Engineering*, 5th edition.,PHI Learning Private Ltd (**Unit-II, III & IV**)

3. Michael L. Shuler ., FikretKargi, *Bioprocess Engineering*, 2nd edition., PHILearning Private Ltd (**Unit -V**)

Reference books:

1. Martin Schmal., *Chemical reaction Engineering*, 2014., CRC Press
2. G. Bond., *Heterogeneous catalysis*., 2nd edition., Oxford University Press

ELECTIVE-II

INDUSTRIAL POLLUTION AND CONTROL

CHE 325(E) **Credits:4**
Instruction : 4 Lectures& 1 Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Prerequisites:
Introduction to Chemical Engineering

Course Objectives:

- To understand the concept, analysis and control of pollution and its effect on man and environment in real scenario.

Course Outcomes:
By the end of the course, the student will be able to:

1. Understand the various types of pollution and their effects on man and environment.
2. Analyze the sources and meteorological aspects of air pollution.
3. Comprehend the sampling and control methods of air pollution.
4. Understand the sampling and control methods of water pollution.
5. Acquire knowledge on management of solid and hazardous wastes.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2					2	2		1	1		1	3	2
	2	3	3	2	2		2	2		1	1		1	3	2
	3	2	3	2	2		2	2		1	1		1	3	2
	4	2	3	2	2		2	2		1	1		1	3	2
	5	2	1	1	1		2	2		1	1	1	1	3	2

UNIT I **12 L+ 3 T**

Introduction: Biosphere, hydrological cycle, nutrient cycle, consequences of population growth, pollution of air, water and soil.

UNIT II **12 L+ 3 T**

Air Pollution: Air pollution sources and its effects-classification and properties of air pollutants, emission sources, behaviour and effect of air pollution.

Meteorological aspects of air pollutant dispersion: Temperature lapse rates and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, estimation of plume rise.

UNIT III **12 L+ 3 T**

Air Pollution Sampling, Measurement and Control: Types of pollutant sampling and measurement, ambient air sampling, stack sampling, analysis of air pollutants.

Air pollution control methods and equipment: Control methods, source correction methods, cleaning of gaseous effluents, particulate emission control, selection of a particulate collector, control of gaseous emissions, design methods for control equipment.

UNIT IV **12 L+ 3 T**

Water Pollution: Water resources, origin of wastewater, types of water pollutants and there effects.

Waste Water Sampling, Analysis and Treatment: **S**ampling, methods of analysis, determination of organic matter, determination of inorganic substances, physical characteristics, bacteriological measurement, basic processes of water treatment, primary treatment, secondary treatment, advanced wastewater treatment, recovery of materials from process effluents.

UNIT V **12 L+ 3 T**

Solid Waste Management: Sources and classification, public health aspects, methods of collection, disposal methods, potential methods of disposal.

Hazardous Waste Management: Definition and sources, hazardous waste classification, treatment methods, disposal methods.

Text Books:

1. Rao C.S., *Environmental Pollution Control Engineering*, Wiley Eastern Limited, India, 1993.
2. Mahajan. S.P., *Pollution Control in Process Industries*, Tata-McGraw Hill, New Delhi, 1985.

Reference books:

1. Glynn Henry J. and Gary W. Heinke, *Environmental Science and Engineering*, 2nd Edition, Prentice Hall of India, 2004.
2. Rao M.N. and Rao H.V.N, *Air Pollution*, Tata – McGraw Hill Publishing Ltd., 1993.
3. De A.K, *Environmental Chemistry*, Tata – McGraw Hill Publishing Ltd., 1999.
4. Noel de Nevers,*Air Pollution and Control Engineering*, McGraw Hill, 2000.

MASS TRANSFER LABORATORY

CHE 326 **Credits: 2**
Instruction: 3 Practical hours/week Sessional Marks: 50
End Exam: 3 Hours End Exam Marks: 50

Prerequisites: Mass Transfer Operations

Course Objectives:
1. To implement the knowledge acquired in mass transfer theory in the laboratory
2. To get acquainted with various mass transfer equipment

Course Outcomes:
By the end of the course, the student will be able to,
1. Determine the diffusion an mass transfer coefficient.
2. Operate the various distillation equipments.
3. Evaluate the performance of mass transfer operations.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3	3	3					3	2		1	2	3
	2	3	3	3	3					3	2		1	2	3
	3	3	3	3	3					3	2		1	2	3

List of Experiments:
1. Liquid Diffusion Coefficient
2. Vapor Diffusion Coefficient
3. Vapor Liquid Equilibria
4. Steam Distillation
5. Differential Distillation
6. Height Equivalent to Theoretical Plate (HETP)
7. Height of Transfer Unit (HTU)
8. Surface Evaporation
9. Liquid-Liquid Extraction in Packed Tower
10. Gas-Liquid Absorption Column
11. Tray Drier
12. Wetted wall column
13. Adsorption isotherms

Prescribed Books:
1. W. L. McCabe, J. C. Smith and P. Harriot, *Unit Operations of Chemical Engineering*, 7th edition, 2005, McGraw-Hill.
2. Robert E. Treybal, *Mass transfer Operations*, 3rd edition, McGraw-Hill.

CHEMICAL REACTION ENGINEERING LABORATORY

CHE 327 **Credits: 2**
Instruction: 3 Practical hours/week Sessional Marks: 50
End Exam: 3 hrs End Exams Marks: 50

Prerequisites: Chemical Reaction Engineering

Course Objectives:
1. To impart knowledge on the determination of the kinetics of a chemical reaction
2. To enable the students to understand the principles involved in designing of chemical reactors

Course Outcomes:
By the end of the course, the student will be able to
1. Determine the kinetics of a chemical reaction in various reactors
2. Acquire hands on experience on the operation of various ideal and non-ideal reactors

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3	3	3					3	2		1	2	3
	2	3	3	3	3					3	2		1	2	3

List of Experiments:
1. Determination of the order of a reaction and rate constant using a batch reactor byanalyzing the data by different methods.
2. Determination of the activation energy of a reaction using a batch reactor.
3. Determination ofthe effect of residence time on conversion and estimation of the rate constant using a CSTR.
4. Determination ofthe effect of residence time on conversion and estimation of the rate constant using a PFR.
5. Determination of RTD and Dispersion number in aTubular reactor using a tracer.
6. Mass transfer with chemical reaction (solid-liquid system) - Determination of Mass Transfer Co-efficient.
7. Determination of RTD and the dispersion number for a packed-bed using a tracer
8. Langmuir Adsorption Isotherm: Determination of surface area of activated charcoal.
9. Performance of a PFR followed by a CSTR
10. Performance of a CSTR followed by a PFR.
11. Performance of two CSTRs in series.
12. Determination of M-M kinetics for an enzyme catalyzed reaction.

Prescribed Books:

1. Octave Levenspiel, *Chemical Reaction Engineering*, 3rd edition, 1999, John Wiley
2. J. M. Smith., *Chemical Engineering Kinetics*, 3rd edition., McGraw-Hill, Inc.
3. H. Scott Fogler., *Elements of Chemical Reaction Engineering*, 5th edition, PHI Learning Private Ltd.

CHEMICAL TECHNOLOGY LABORATORY

CHE 328 **Credits: 2**
Instruction: 3 Practical hours/week Sessional Marks: 50
End Exam: 3 hrs End Exams Marks: 50

Prerequisites: Chemical Technology, Engineering Chemistry

Course Objectives:
1. To impart the knowledge on analyzing water and other compounds
2. To familiarize with the production of different industrial products on laboratory scale

Course Outcomes:
By the end of the course, the student will be able to
1. Analyze water and other compounds
2. Prepare different industrial products on laboratory scale

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3	3	3		2	2		3	2		1	2	3
	2	3	3	3	3		1			3	2		1	2	3

List of Experiments:
1. Total solids, dissolved solids,pH
2. Chlorides and sulphates
3. Temporary, permanent and total hardness.
4. Analysis of oils: Acid value, Iodine value, Saponification value
5. Analysis of coal: Proximate analysis
6. Analysis of lime: Estimation of acid insolubles, available lime and calcium carbonate
7. Analysis of bleaching powder: Estimation of chlorine content.
8. Analysis of starch/glucose: Estimation of total reducing sugars
9. Analysis of saw dust: Estimation of total cellulose
10. Preparation of soap
11. Preparation of copper pigment
12. Preparation of chrome yellow pigment
13. Preparation of phenol formaldehyde resin
14. Estimation of COD

Prescribed books:

1. Sunitha Rattan, *Experiments in Applied Chemistry*” 2nd edition, 2004, S. K. Kattaria& Sons .
2. GopalaRao, M. and Marshall Sitting, *Dryden’s out lines of Chemical Technology*, 3rd edition, East West Press Pvt.Ltd.
3. Kirk R .E. and Othmer D. F., *Encyclopedia of Chemical Technology, 4th edition*, Inter Science.

Quantitative Aptitude II

3/4 B. Tech, Semester II

Course Objectives:

- To categorize, apply and use thought process to distinguish between concepts of reasoning
- To prepare and explain the fundamentals related to various possibilities and probabilities related to quantitative aptitude.
- To critically evaluate numerous possibilities related to puzzles.

Course Outcomes:

The student will be able to
- Use their logical thinking and analytical abilities to solve reasoning questions from company specific and other competitive tests.
- Solve questions related to permutation & combinations and probabilities from company specific and other competitive tests.
- Understand and solve puzzle related questions from specific and other competitive tests.

UNIT I **8 Periods**

Numerical Reasoning:

Problems related to Number series, Analogy of numbers, Classification of numbers, Letter series, Seating arrangements, Directions, blood relations and puzzle test.

UNIT II **4 Periods**

Combinatorics:

Counting techniques, Permutations, Combinations and Probability

UNIT III **4 Periods**

Syllogisms and data sufficiency

UNIT IV **4 Periods**

Application of Base system:
Clocks (Base 24), Calendars (Base7), Cutting of Cubes and cuboids

UNIT V **4 Periods**

Puzzle Solving & Time Management using various problems solving tools and techniques:
Selective puzzles from previous year placement papers
Selective puzzles from book Puzzles to puzzle you by Shakunatala devi
Selective puzzles from book more puzzles by Shakunatala devi
Selective puzzles from book puzzles by George Summers

Books for practice

1. Quantitative aptitude by R S Agarwal, S Chand Publications
2. Verbal and nonverbal Reasoning by R S Agarwal, S Chand publications
3. Puzzles to puzzle you by Shakunatala devi orient paperback publication
4. More puzzles by Shakunatala devi orient paperback publication
5. Puzzles by George summers orient paperback publication.

References:

1. Barron’sbySharonWelnerGreenandIraKWolf(GalgotiaPublicationspvt.Ltd.)
2. Materialfrom‘IMS,CareerLauncherandTime’institutesforcompetitiveexams.
3. ReasoningbyBSSijwaliArihantpublications
4. ReasoningArunSharmaMcGrawhillpublications

Websites:

1. www.m4maths.com
2. www.Indiabix.com
3. 800score
4. Official GREsite
5. Official GMATsite

Verbal Ability II & Employability Skills
3/4 B.Tech , Semester II

Course Objectives

1. To prepare the students on various aspects of effective writing by selecting and organizing relevant information

2. To list and discuss selected high frequency words, their antonyms, synonyms, etc.

3. To demonstrate and recommend various techniques for effective speaking in different situations

4. To illustrate and explain about the different types of questions asked in competitive exams and the techniques to be used to solve them

5. To plan group activities in order to provide opportunities for students to demonstrate professionalism and corporate readiness

Course Outcomes

By the end of this course, the student will be able to:

1. Write paragraphs, essays, emails, stories and summaries of group discussions on given topics.

2. Converse with ease during interactive sessions in their classrooms, compete enthusiastically in group activities like debates, elocutions, JAM's, presentations.

3. To solve different types of questions based on vocabulary, structure, grammar and verbal reasoning

4. To demonstrate corporate readiness in terms of attitude, communication, team work and emotional balance

Unit 1 **6 Periods**

Writing Skills

Essay Writing – Paragraph Writing – Story Writing – Business Letter Writing – Email Writing – Resume Writing

Unit 2 **8 Periods**

Vocabulary

Synonyms and Synonym Variants (High Frequency Words) – Antonyms and Antonym Variants (High Frequency Words) – Homonyms – Hyponyms and General Idioms – Frequently Confused Words

Unit 3 **8 Periods**

Speaking Skills

JAM Sessions, Group Discussion Sessions, Debates, Extempore Speeches, Mock Interviews

Unit 4 **4 Periods**

Corporate Readiness

Demonstrating Positive Attitude – Communicating Effectively – Building Interpersonal Relationships – Working in Teams – Managing Emotions

Reading/ Listening material:

1. Newspapers like 'The Hindu', 'Times of India', 'Economic Times'.
2. Magazines like Frontline, Outlook and Business India.
3. News channels NDTV, National News, CNN

References:

1. Books written by Stephen Covey and Dale Carnegie Seven Habits of Highly Effective People etc-Simon&Schuster, Running Press book publishers

2. Books written by Bertrand Russell-Oxford University Press

Suggested General Reading

1. **WhoMovedMyCheese?**BySpencerJohnson-GPPutnam'sSons
2. **TheartofWar**-SunTzubyNabla,Barnes&Noble
3. **TheMonkWhoSoldFerrari**-RobinSharmabyHarperCollins,JaicoPublishers
4. **TheHobbit**andotherbooksbyJRRTolkein-HarperCollins

Suggested Authors

WilliamDalrymple	V.S.Naipaul	KushwanthSingh	ErnestHemingway
CharlesDickens	LeoTolstoy	R.K.Narayan	AmitavGhosh
VikramSeth	OscarWilde	SudhaMurthy	AnshuSingh

TRANSPORT PHENOMENA

CHE 412 **Credits:4**
Instruction : 4Lectures& 1Tut. /Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Prerequisites:
Engineering Mathematics, Momentum Transfer, Heat Transfer and Mass Transfer

Course Objectives:

1. To provide basic knowledge on laminar flow using shell balances in momentum, heat and mass transfer.
2. To familiarize with equation of change for non-isotheral systems.
3. To acquaint knowledge on velocity, temperature and concentration distributions in turbulent flow.

Course Outcomes:
By the end of the course, the student would be able to:

1. Determine the dependency of transport properties on pressure and temperature.
2. Identify the coordinates and develop velocity, temperature and concentration profiles in laminar flow.
3. Apply equations of change for non-isothermal systems for solving steady state problems.
4. Evaluate velocity distributions using time smoothed quantities.
5. Estimate the friction factors, heat transfer coefficients and mass transfer coefficients.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1	1	1	1				1	1		1	2	3
	2	2	2	2	2	1				1	1		1	2	3
	3	3	3	3	3	1				1	1		1	2	3
	4	2	2	2	2	1				1	1		1	2	3
	5	2	2	2	2	1				1	1		1	2	3

SYLLABUS

UNIT-I **12L + 3T**

Momentum transport: Viscosity and the mechanism of momentum transport, Newton's law of viscosity, Non-Newtonian fluids and pressure and temperature dependence of viscosity.
Velocity distributions in laminar flow: Shell momentum balances boundary conditions, flow of a falling film, flow through a circular tube and flow through an annulus.

UNIT-II **12L + 3T**

The equations of change for isothermal systems: The equations of continuity, motion and mechanical energy in rectangular and curvilinear coordinates, use of the equations of change to set up steady flow problems and dimensional analysis of the equations of change.

Velocity distributions in turbulent flow: Fluctuations and time-smoothed quantities, time-smoothing of the equations of change for an incompressible fluid and semi empirical expressions for the Reynolds stresses.

UNIT-III **12L + 3T**

Energy transport: Thermal conductivity and the mechanism of energy transport, Fourier's law of heat conduction and temperature and pressure dependence of thermal conductivity in gases and liquids.

Temperature distributions in solids and in laminar flow: Shell energy balances boundary conditions, heat conduction with an electrical heat source, heat conduction with a viscous heat source, heat conduction through composite walls, forced convection and free convection.

UNIT-IV **12L + 3T**

Mass transport: Diffusivity and mechanism of mass transport, Definitions of concentrations, velocities and mass fluxes, Fick's law of diffusion and temperature and pressure dependence of mass diffusivity.

Concentration distribution in solids and in laminar flow: Shell mass balances – boundary conditions, diffusion through a stagnant gas film, diffusion with heterogeneous chemical reaction, mass transfer with chemical reaction, diffusion with homogeneous chemical reaction and diffusion into a falling liquid film.

The equations of change for multi component systems: The equations of continuity for a binary mixture.

UNIT-V **12L + 3T**

Interphase transport in isothermal systems:Definition of friction factors, friction factors for flow in tubes and for flow around spheres.Definition of the heat transfer coefficient, heat transfer coefficients for forced convection in tubes and around submerged objects and heat transfer coefficients for free convection.Definition of binary mass transfer coefficients in one phase, correlations of binary mass transfer coefficients in one phase at low mass-transfer rates, definition of binary mass-transfer coefficients in two phases at low mass-transfer rates and definition of the transfer coefficients for high mass transfer rates.

Text Book:

1. R. Byron Bird, Warren E. Steward and Edwin N. Lightfoot, *Transport Phenomena*, 1st edition, John Wiley and Sons Inc., New York, 1960.

Reference Books:

1. Geankoplis, C.J. *Transport Processes and UNIT Operations*, PHI, New Delhi, 3rd edition, 1997.
2. V. Kumaran, *Transport processes*, course module available at http://chemeng.iisc.ac.in/kumaran/courses.html.

PROCESS DYNAMICS AND CONTROL

CHE 413 | **Credits: 4**
Instruction: 4 Lectures&1Tut./Week | Sessional Marks: 40
End Exam: 3 Hours | End Exam Marks: 60

Prerequisites:
Engineering Mathematics

Course Objectives:

1 To know about linear chemical process problems and control configurations
2 To understand control strategies

Course Outcomes:
By the end of the course, the student will be able to:

1 Formulate and solve linear chemical processes
2 Develop block diagram and transfer function for a closed loop system.
3 Analyze stability of control systems
4 Analyze the response of processes for various controllers
5 Acquire the knowledge on advanced control strategies, controller tuning and control valves.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	2	2					1	1		1	2	3
	2	3	2	2	2					1	1		1	2	3
	3	3	3	3	3					1	1		1	2	3
	4	3	2	2	2					1	1		1	2	3
	5	3	1	1	1					1	1		1	2	3

SYLLABUS

UNIT- I **12L + 3T**

Linear open loop systems: Simple first order and second order systems, physical examples of first and second order systems, response of first order systems in series, transportation lag

UNIT-II **12L + 3T**

Linear closed loop systems : The control systems, controllers , final control element, block diagram of chemical reactor control systems, closed loop transfer functions , transient response of simple control systems

UNIT-III **12L + 3T**

Stability: Stability, root locus, frequency response, control system design by frequency response, Bodediagram, Bode stability criteria

UNIT-IV **12L + 3T**

Analysis and design of feedback control systems: Concept of feedback control, types of feedback controllers, measuring devices, final control elements, dynamic behavior of feedback control process, block diagram and closed loop response, effect of proportional, integral and derivative control action on the response of a controlled process

UNIT-V **12L +**

3TAnalysis and design of control systems: Cascade control, feed forward control, ratio control

Introduction to process applications: Controller tunings, controller mechanisms, control valves

Text Books:

1 Donald R. Coughnowr, Steven E. LeBlanc*Process Systems Analysis and Control*, 3rdEd., McGraw-Hill Education India Pvt. Ltd., 2013.

References:

1 G.Stephanopoulos, *Chemical Process Control: An Introduction to Theory & Practice*, PHI, 1983

2 W. B.Bequette, *Process Control: Modelling, Design and Simulation*, Prentice Hall, 1998

3 D.Seborg, T.F. Edgar Duncan, A. Mellichamp, *Process Dynamics and Control*,3rd Ed., John Wiley &Sons, Inc, 2010

PROCESS MODELING AND SIMULATION

CHE 414 **Credits:4**

Instruction : 4 Lectures& 1Tut./Week Sessional Marks : 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisites: Process Control, Heat transfer, Mass transfer, Chemical reaction engineering, Fluid Mechanics.

Course Objectives:

1. To use the fundamental laws in developing model equations.
2. To understand various chemical engineering systems.
3. To develop mathematical models for solving process problems.
4. To gain skills by proper usage of simulators for modelling chemical processes.

Course Outcomes:

By the end of the course the student will be able to:

1. Apply the fundamental laws to develop a mathematical model for simple flow systems.
2. Formulate mathematical models for various types of reactors
3. Develop a mathematical model for various Mass transfer equipment.
4. Solve the mathematical models using numerical methods.
5. Simulate mathematical models for various operations.

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	2	2					1	1		1	2	3
	2	3	3	3	3					1	1		1	2	3
	3	3	3	3	3					1	1		1	2	3
	4	3	1	1	1	2				1	1		1	2	3
	5	3	2	2	2	3				1	1		1	2	3

SYLLABUS

UNIT -I **12L+3T**

Introduction: Use and scope of mathematical modeling, Principles of model formulation, Role and importance of steady-state and dynamic simulation, Degree-of-freedom analysis, Selection of design variables, Model simulation.

Fundamental laws: Equations of continuity, energy, momentum, and state, Transport properties, Equilibrium and chemical kinetics, Review of thermodynamic correlations for the estimation of physical properties like phase equilibria, bubble and dew points.

UNIT –II **12L+3T**

Mathematical modeling-I: Chemical processes-Gravity flow tank, Two heated tanks, Gas phase pressurized CSTR, Non-isothermal CSTR, Series of isothermal, constant hold up CSTRs, CSTRs with variable hold-ups.

UNIT-III **12L+3T**

Mathematical modeling-II: Modeling of Single component vaporizer, Multicomponent flash drum, pH systems, Batch reactor, Reactor with mass transfer, Ideal binary distillation and Batch distillation with holdup.

UNIT-IV **12L+3T**

Methods for solving non-linear equations: Interval Halving method, Newton-Raphson method, False Position method, Wegstein method. Numerical integration of ordinary differential equations: Euler Algorithm and Runge-Kutta (Fourth-Order) methods.
General Concepts of Simulation for Process Design: Introduction, modular approaches to process simulation- sequential modular approach, simultaneous modular approach, equation solving approach, tearing.

UNIT-V **12L+3T**

Simulation examples: Gravity flow tank, Three CSTRs in series with constant hold-up, Three CSTR's in series with variable hold-up. Simulation of Non-isothermal CSTR, Batch reactor and Binary distillation column.

Textbooks:

1. W. L. Luyben, Process Modeling, Simulation and Control for Chemical Engineers, 2nd Ed., McGraw Hill India Pvt. Ltd., 2014.
2. Raghu Raman ,Chemical Process Computations,Elsevier Applied Science Publishers Ltd., New York, 1985 (**UNIT-IV**)

Reference Books:

1. Upreti, Simant R. Process Modeling and Simulation for Chemical Engineers: Theory and Practice. John Wiley & Sons, 2017.
2. Verma, Ashok Kumar. Process Modelling and Simulation in Chemical, Biochemical and Environmental Engineering. CRC Press, 2014.
3. H. Scott Fogler, Elements of Chemical Reaction Engineering, 3rd Ed., Prentice Hall of India, 2004.

PETROLEUM REFINERY ENGINEERING

CHE 415(A) **Credits: 4**

Instruction: 4 Lectures& 1Tut./ week Sessional marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisites:
Engineering chemistry and organic chemistry

Course Objectives:

1. To understand the scenario of petroleum refining and future prospects.
2. To understand the process technologies for the petroleum products.
3. To understand suitable processes for obtaining the desired petroleum cuts.

Course Outcomes:
By the end of the course the student will be able to:

1. Outline the formation of crude oil and its reserves
2. Acquire knowledge on pretreatment and fractionation of petroleum
3. Predict the suitable treatment techniques for the desired products
4. Classify various petroleum cracking operations
5. Identify different refinery value addition processes

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
	1	2								1	1		1	3	2
	2	2	1	1	1					1	1		1	3	2
CO	**3**	2	1					1		1	1		1	3	2
	4	2								1	1		1	3	2
	5	2								1	1		1	3	2

SYLLABUS

UNIT-I **12L+3T**

Origin, formation and composition of petroleum: Origin, formation and composition of petroleum, Reserves and deposits of world, Petro Glimpses and petroleum industry in India, future prospects.

UNIT-II **12L+3T**

Petroleum processing data: Evaluation of petroleum, thermal properties of petroleum fractions, important products, properties and test methods.

Fractionation of petroleum: Dehydration and desalting of crudes, heating of crude pipe still heaters, atmospheric and vacuum distillation, blending of gasoline.

UNIT-III **12L+3T**

Treatment techniques: Fraction-impurities, treatment of gasoline, treatment of kerosene, treatment of lubes.

UNIT-II **12L+3T**

Cracking processes: Thermal cracking, Hydrocracking, Catalytic cracking and - Feed stocks - Catalysts - Process variables, Naphtha cracking, Coking, Visbreaking processes.

UNIT-V

Refining processes: **12L+3T**

Hydrogenation process, Catalytic reforming, Alkylation processes, Isomerization, Polymerization, Hydrotreating, Asphalt and air blown asphalt.

Textbooks:

1. B.K. BhaskaraRao, *Modern Petroleum Refining Processes*, 5th Edition, Oxford & IBHPublishing, 2011.
2. Nelson, W.L. *Petroleum refining Engineering*, 4th Edition, McGraw Hill, New York, 1969. **(UNIT IV & V)**

Reference Books:

1. Ram Prasad,*Petroleum Refining Technology*, 1stEdition, Khanna Publishers, 2002.
2. J.H. Gary and G.E.Handwerk,*Petroleum Refining Technology and Economics*, 4thEdition, Marcel Dekkar Inc., 2001.

CHEMICAL ENGINEERING COMPUTATIONS

CHE 415(B) **Credits :4**
Instruction: 4 Lectures & 1Tut. / Week Sessional Marks : 40
End Exams : 3 hr End Exams Marks : 60

Prerequisites
Fluid Mechanics, Heat Transfer, Mass Transfer

Course Objectives

1. To impart the application of computations in Chemical Engineering

Course Outcomes
By the end of this course, students will be able

1. To mathematically formulate the chemical process
2. To mathematically formulate chemical equilibria with two or more equations
3. To mathematically formulate reactions in chemical reactors with two or more equations
4. To simulate mass transfer equipment
5. To simulate transport processes in one dimension

CO –PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	2						1	1		1	3	2
	2	3	2	2						1	1		1	3	2
	3	3	2	2						1	1		1	3	2
	4	3	2	2	2	1				1	1		2	3	2
	5	3	2	2	2	1				1	1		2	3	2

SYLLABUS

UNIT-I **12L + 3T**

Introduction: Algebraic equations, Process Simulation, Differential Equations

Equation of State: Mathematical Formulation, solving equations of state using excel and MATLAB

UNIT-II **12L + 3T**

Vapor Liquid equilibria: Flash and phase separation, Isothermal flash- Development of equations, Thermodynamic parameters, Non ideal liquids- Test of thermodynamic models

Chemical Reaction Equilibria: Chemical equilibrium expression, Chemical equilibria with two or more equations, Example of hydrogen for fuel cells,

UNIT- III **12L + 3T**

Chemical Reactors: Mathematical formulation of reactor problems, Batch reactor, plug flow reactor, chemostat, Reactor problems with mole changes and variable density, Chemical reactors with mass transfer limitions

UNIT- IV **12L + 3T**

Simulation of Mass Transfer Equipment: Mathematical modeling of distillation with rigorous plate to plate methods, Packed bed adsorption, gas plant production separation,

UNIT -V **12L + 3T**

Transport Process in one dimension: Applications in Chemical Engineering- Mathematical formulations, heat transfer in slab, reaction and diffusion, flow of Newtonian and non Newtonian fluid in a pipe, Transient heat transfer, Linear Adsorption, Chromomatography.

Textbook

1. Bruce A. Finlayson, *Introduction to Chemical Engineering Computation*, John Wiley and Sons Inc., 1st edition, 2012.
2. Kenneth. J. Beers, Numerical Methods in Chemical Engineering, Cambridge Press, 2nd edition, 2007

References

1. C. D. Holland, *Fundamentals and Modelling of Separation Processes*, Prentice Hall Inc., New Jersey, 1975
2. Tarhan. M. Orhan, *Catalytic Reactor Design*, McGraw Hill, 1983
3. R. K. Sinnot,Coulson& Richardson, *Chemical Engineering Volume – 6: Chemical Engineering Design*, 3rd Edition, Butterworth – Heinemann Publication.

NANOTECHNOLOGY

CHE 415(C) **Credits:4**
Instruction : 4 Lectures& 1Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Course Objectives:

1. To provide a basic understanding of nanotechnology and its importance towards chemical engineering

Course Outcomes:

By the end of the course, the student will be able to:

1. Understand the basics of nanotechnology
2. Classify different classes of nanomaterials
3. Apply nanotechnology to chemical and its related industries
4. Process Design different synthesis route of nanomaterials
5. Apply chemical reaction engineering concepts for production of different nanomaterials

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3								1	1		1	3	2
	2	3	1							1	1		1	3	2
	3	2	1							1	1		1	3	2
	4	3	1	1	1					1	1		1	3	2
	5	3	1	1	1					1	1		1	3	2

SYLLABUS

UNIT-I **12L+3T**

Basics and Scale of Nanotechnology: Introduction, Scientific revolutions, Time and length scale in structures, Definition of a nanosystem, Dimensionality and size dependent phenomena, Surface to volume ratio -Fraction of surface atoms, Surface energy and surface stress, surface defects, Properties at nanoscale (optical, mechanical,electronic,and magnetic).

UNIT-II **12L+3T**

Nanomaterials: Classification based on dimensionality, Quantum Dots, Wells and Wires,Carbonbasednano materials (buckyballs, nanotubes, graphene)Metalbasednanomaterials (nanogold, nanosilver and metal oxides) Nanocomposites, Nanopolymers. Nanoglasses, Nano ceramics, Biologicalnanomaterials.

UNIT-III **12L+3T**

Nanotechnology to Nano Engineering: Introduction to nanotechnology, Process Technology in nanoengineering, Chemical engineering and new materials, Application of nanotechnology to different fields: Nanotechnology in Biotechnology, Nanotechnology in

Petroleum Industries, Nanotechnology in Material Science, Nanotechnology in Environmental Science, Nanotechnology in the Energy Sector, Nanotechnology in Other Specific Fields

UNIT-IV **12L+3T**

Nanostructured materials synthesis, Concepts and design: Synthesis Technologies and Challenges, Top down methods, Bottom-up Methods, Routine Tests for Characterization of Nanostructures, particle characterization, Chemical Analysis, Thermal analysis

UNIT-V **12L+3T**

Nanostructured materials manufacturing: Kinetic approach of the reaction, Chemical reactors for manufacturing nanomaterials, Health safety and Environment issues.

Text Book:

1. Pradeep T., *A Textbook of Nanoscience and Nanotechnology*, Tata McGraw Hill Education Pvt. Ltd., 2012.(**UNIT-I &II**)
2. Said SalaheldeenElnashaie, FiroozehDanafar, Hassan Hashemipour Rafsanjani, *Nanotechnology for Chemical Engineers*, Springer, 2015. (**UNIT-III to V**)

Reference Books:

1. Hari Singh Nalwa, *Nanostructured Materials and Nanotechnology*, Academic Press, 2002.
2. Nabok A., *Organic and Inorganic Nanostructures*, Artech House, 2005.
3. Dupas C., Houdy P., Lahmani M., *Nanoscience: Nanotechnologies and Nanophysics*, Springer-Verlag Berlin Heidelberg, 2007.

COMPUTATIONAL FLUID DYNAMICS

CHE 415(D) **Credits:4**

Instruction : 4Lectures& 1Tut/Week — Sessional Marks : 40

End Exam : 3 Hours — End Exam Marks: 60

Prerequisites:

Engineering Mathematics, Momentum Transfer and Heat Transfer.

Course Objectives:

1. To develop a general method of prediction for momentum, heat and mass transfer.
2. To familiarize with different methods of prediction.

Course Outcomes:

By the end of the course, the student will be able to:

1. Familiarize with the relevance and identification of the governing equations.
2. Understand the various discretization methods
3. Apply the numerical methods to solve physical process that are governed mathematical equations containing only diffusion type.
4. Apply the numerical methods to solve physical process that are governed mathematical equations containing both diffusion and convection type.
5. Know the procedure to estimate the pressure and velocity corrections for calculation of flow field

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	2	2	1				1	1		1	3	2
	2	3	2	2	2	1				1	1		1	3	2
	3	3	2	2	2	1				1	1		1	3	2
	4	3	2	2	2	1				1	1		1	3	2
	5	3	2	2	2	1				1	1		1	3	2

SYLLABUS

UNIT-I **12L+3T**

Mathematical description of physical phenomena: Conservation of chemical species, energy equation, momentum equation, time average equations for turbulent flow, the turbulence kinetic energy equation, general differential equation.

UNIT-II **12L+3T**

Discretization methods: Discretization concept, structure of discretization equation, Taylor series formulation, variational formulation, method of weighted residuals, control volume formulation.

UNIT-III **12L+3T**

Steady and unsteady state molecular phenomena: Steady one dimensional equation – basic equation, grid spacing, non-linearity, sourse term linearization, boundary conditions and solution. Unsteady one dimensional equation – general discretization equation, explicit, Crank-Nicolson, Fully implicit schemes and equations.

UNIT-IV **12L+3T**

Steady and unsteady state molecular and convection phenomena: Upwind scheme, exact solution, exponential scheme, hybrid scheme, power law scheme, generalized formulation and consequences of various schemes.

UNIT-V **12L+3T**

Calculation of flow field: The momentum equations, the pressure and velocity corrections, the pressure correction equation, SIMPLE algorithm, SIMPLER algorithm.

Text Book:

1. Suhas V. Patankar, *Numerical Heat Transfer and Fluid Flow*, McGraw Hill Book Company, New York, 1980.

Reference Books:

1. Anil W. Date, *Introduction to Computational Fluid Dynamics*, Cambridge University press, 2005.
2. Muralidhar K. and Sundararajan T., *Computational Fluid Flow and Heat Transfer*, Narosa Publishing House, 2003.

FUNDAMENTALS OF BIOLOGICAL SCIENCES

CHE 415(E) **Credits:4**
Instruction : 4 Lectures& 1Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Course Objectives:

1. To provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers.
2. To encourage engineering students to think about solving biological problems with engineering tools.

Course Outcomes:

By the end of the course, the student will be able to:

1. Classify various microorganisms
2. Identify different types of bacteria
3. Draw structures of different biomolecules
4. Identify DNA as a genetic material in the molecular basis of information transfer.
5. Classify different types of immune system of humans combating with pathogens

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2								1	1		1	1	1
	2	2								1	1		1	1	1
	3	2								1	1		1	1	1
	4	2								1	1		1	1	1
	5	2								1	1		1	1	1

SYLLABUS

UNIT-I **12L+3T**

Importance of Biology and Classification of microorganisms: Fundamentaldifferences between science and engineering- comparing eye and camera, flying bird and aircraft. Major discoveries in biology from 18th century (Robert Brown and Julius Von Mayer).Classification of organisms based on Cellularity, Energy and carbon utilization, Ammonia excretion, Habitat. Molecular taxonomy- Five kingdom classification- Characteristics, Structure, Nutrition, Reproduction, Economic importance and pathogenicity.

UNIT-II **12L+3T**

Microbiology: Microbial taxonomy- Taxonomic ranks, concept of species and strains, Classification systems-phenetic, phylogenetic and molecular parameters. Concept of single celled organisms, Microscopy- optical microscopy, electron microscopy and their uses. Identification methods of bacteria -based on shape, arrangement of cells, gram staining, metabolic differences and biochemical characteristics, Ecological aspects of single celled organisms.

UNIT-III **12L+3T**

Biochemistry: Molecules of life, Structure, properties and functions of carbohydrates (Mono-, di- and polysaccharides), Proteins (Aminoacids-types; proteins Types, classification (Enzymes, Transporters, receptors, and structural elements) and hierarchy of structure), Nucleic acids (Nucleotides, DNA & RNA), Lipids (Simple lipids, compound lipids & derived lipids).

UNIT-IV **12L+3T**

Genetics: DNA as a genetic material, Hierarchy of DNA structure-from single to double helix to nucleosomes. Concept of genetic code- characteristics.Introduction to central dogma.Definition of gene in terms of complementation and recombination.Outlines of Mitosis and Meiosis and its significance.

UNIT-V: **12L+3T**

Immune System: Overview of the Immune System: Innate and adaptive immune system components, T-lympcytes, Antigen presenting cells, MHC molecules bind antigenic peptides, Immune dysfunction and its consequences

Text Book:

1. Thyagarajan S., Selvamurugan N., Rajesh M. P., Nazeer R. A., Richard Thilagaraj W, Barathi S., and Jaganathan M. K., *Biology for Engineers*, Tata McGraw-Hill, New Delhi, 2012.
2. Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne , *Kuby Immunology*, 7th Edition, 2013 (**UNIT-V**)

Reference Books:

1. Jeremy M. Berg, John L. Tymoczko and LubertStryer, *Biochemistry*, W.H. Freeman and Co. Ltd., 6th Ed., 2006.
2. Robert Weaver, *Molecular Biology*, MCGraw-Hill, 5th Edition, 2012.
3. B.D. Singh, *Fundamentals of Genetics*, Kalyani Publishers, 2004.

PROCESS DYNAMICS AND CONTROL LABORATORY

CHE 416 **Credits:2**
Instruction : 3Practical hours per week Sessional Marks : 50
End Exam : 3 Hours End Exam Marks: 50

Prerequisites:
Engineering Mathematics, Process dynamics and control

Course Objectives:
1. To impart knowledge on the determination of time constants of a process.
2. To enable the students in designing a controller.

Course Outcomes:
By the end of the course, the student will be able to:
1. Determine the response and time constants of various process
2. Acquire hands on experience on the operation of various Controllers

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	3	3					3	2		1	2	3
	2	3	3	3	3	3				3	2		1	2	3

List of experiments
1. Response of mercury-in glass thermometer
2. Response of mercury-in glass thermometer with thermal well.
3. Response of manometer
4. Response of single tank liquid level system
5. Response of two tank non-interacting liquid level system
6. Response of two tank interacting liquid level system
7. Study of control valve coefficient.
8. Valve characteristics of a control valve
9. Response of pressure control trainer for sinusoidal input
10. Pressure control trainer
11. Temperature control trainer
12. Level control trainer

Prescribed Books:

1. Donald R. Coughnowr, Steven E. LeBlanc*Process Systems Analysis and Control*, 3rdEd., McGraw-Hill Education India Pvt. Ltd., 2013.
2. G. Stephanopoulas, *Chemical Process Control- An Introduction to Theory andPractice,*Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
3. B. Wayne Bequette, *Process Control – Modeling Design and Simulation,* Prentice Hall, 1st edition, 2003.

PROCESS MODELLING AND SIMULATION LABORATORY

CHE 417 **Credits:2**
Instruction : 3practical hours per week Sessional Marks : 50
End Exam : 3 Hours End Exam Marks: 50

Prerequisites:
Engineering Mathematics, Process Modelling and Simulation

Course Objectives:
1. To impart knowledge on simulation packages and tools.
2. To enable the student to have hand on experience on various simulation tools.

Course Outcomes:
By the end of the course, the student will be able to:
1. Represent the process in terms of mathematical equations.
2. Acquire hands on experience on simulation packages and tools.

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	3	3	3				2	2		2	2	3
	2	3	3	3	3	3				2	2		2	2	3

List of experiments
1. Estimation of thermodynamic properties
2. Vapour liquid Equilibria
3. Simulation of a pump
4. Simulation of a heat exchanger
5. Simulation of an evaporator
6. Simulation of an absorber
7. Simulation of distillation column
8. Simulation of a reactor
9. Simulation of a flowsheet
10. Simulation of a flowsheet with recycle stream
11. Optimization of process parameters in a flowsheet
12. Unsteady state operation of a flowsheet

The experiments can be performed in any software / tool to have hands on experience.

Prescribed Books:

1. Bruce A. Finlayson, *Introduction to Chemical Engineering Computation*, John Wiley and Sons Inc., 1st edition, 2012.
2. W. L. Luyben, Process Modeling, Simulation and Control for Chemical Engineers, 2nd Ed., McGraw Hill India Pvt. Ltd., 2014.
3. A. K. Jana, *Chemical Process Modelling and Computer Simulation,* PHI, 2nd edition, 2011.

SEMINAR

CHE 418 **Credits: 4**

Instruction: 3 practical hours/Week Sessional Marks: 100

Course Objectives:

1. To provide knowledge in preparing Technical Reports
2. To familiarize with the power point presentations
3. To enhance communication skills

Course Outcomes:

By the end of the course, the student will be able to:

1. Prepare Technical Reports
2. Develop Presentation and Communication Skills

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1	1	2	2			1	3	3		2	2	3
	2	1	1	1	1	2			1	3	3		2	2	3

- Seminars are conducted in two phases to evaluate the knowledge, presentation skills of the student.
- For each presentation 50 marks are allotted to each student by the four evaluators.
- Marks have been awarded based on the performance of the student in terms of presentation skills, communication skills, knowledge on the topic.
- Finally all the marks obtained in the two phases are averaged to award total marks for the project

Industrial Training

CHE 419 **Credits: 2**

End Exam Marks: 100

Course Objective:

To gain an insight of various unit operations and processes in a chemical industry.

Course Outcomes:

By the end of the course, the student would be able to

1. Practically analyze various unit operations and processes in a chemical industry.
2. Prepare a technical report

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1	1	1	1	1	1	1	3	3	2	3	3	3
	2	3	1	1	1				1	3	3	1	3	3	3

❖ Assesment for the industrial training is made through external examiner during IV year I Sem

CHEMICAL PROCESS ECONOMICS

AND EQUIPMENT DESIGN

CHE 421 **Credits: 4**
Instruction: 4 Lectures&1Tut./Week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisites:
Heat Transfer, Mass Transfer

Course Objectives:
1 To familiarize process development and general design considerations.
2 To provide the knowledge on mechanical design of equipments.
3 To familiarize the design of heat and mass transfer equipments.
4 To provide the knowledge of various equations used for cost analysis of process plant

Course Outcomes:
By the end of the course, the student would be able to
1 Outline the general design considerations for design / expansion of the process.
2 Estimate the time value of money and depreciation
3 Compute the cost of an equipment and process plant
4 Evaluate mechanical design of equipment.
5 Design process equipment

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3	3	3					1	1		1	2	3
	2	1	1	1	1					1	1	3	1	2	3
	3	3	2	2	2					1	1	3	1	2	3
	4	3	2	2	2					1	1		1	2	3
	5	3	3	3	3	2				1	1		1	2	3

SYLLABUS

UNIT-I **12L+3T**

General process design considerations: Procedure for project design, design information from the literature survey, flow diagrams, preliminary design, comparison of different processes, firm process design, equipment design and specialization, scale up in design, safety factors specifications, health and safety hazards, fire and explosion hazards, personnel safety, loss prevention, plant location and layout.

UNIT-II **12L+3T**

Value of money and depreciation: Types of interest- discrete and continuous, equations for economic studies, annuities - relation between ordinary annuity and the periodic payments, value of a bond, types and various methods of calculating depreciations, depreciation accounting.

UNIT-III **12L+3T**

Cost estimation and Profitability: Basic relationship in accounting, balance sheet and income statement, various ratios to study the balance sheet and income statements, break even chart, cost indices, capacity factors, cost estimation of an equipment and process plant, alternate investments and replacements for profitability evaluation.

UNIT-IV **12L+3T**

Mechanical design of process equipment: Pressure vessel shell, closures, nozzles, flanges, supports, storage vessels, tall vertical column, reactor.

UNIT-V **12L+3T**

Process equipment design: Design of Heat exchanger, evaporator, distillation column, absorption column.

Text Books:

1 M. S. Peters &K.D.Timmerhaus, *Plant design and Economics for Chemical Engineers,* 4th edition, McGraw Hills Publishing Company,1991.

2 M.V.Joshi,*Process Equipment Design*, 3rd Edition, MacMillan India Ltd 1981(**UNIT-II**)

References:

1. Hebert E. Schweyer, *Process Engineering Economics,* McGraw Hill Books company 1955.
2. J.M.Coulson&J.F.Richardon, *Chemical Engineering Volume-VI (An introduction to Chemical Engineering Design*
3. J.R.Backhurst&J.H.Harker,*Process-Plant-Design*,Heieman Education London.

RESERVOIR ENGINEERING

CHE 422(A) **Credits:4**
Instruction: 4 Lectures& 1Tut. / Week Sessional Marks : 40
End Exams : 3 hr End Exams Marks : 60

Prerequisites
Chemical Process Calculations, Fluid Mechanics, Chemical Technology, Mass Transfer

Course Objectives
1. To impart knowledge on basic terminology of Reservoir Engineering
2. To impart knowledge of salient features of an oil reservoir
3. To give the basic material balance of the reservoir resources
4. To make aware of importance of pressurizing an oil reservoir
5. To give an in-depth understanding of enhanced oil recovery methods

Course Outcomes
By the end of this course, students will be able
1. To understand the terms and denotations of an Oil Reservoir
2. To know the features and identifications of an Oil Reservoir
3. To perform material balances of the reservoir resources
4. To understand the need for maintaining pressure in an oil reservoir
5. To understand the different levels of enhanced oil recovery methods

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2								1	1		1	3	2
	2	2								1	1		1	3	2
	3	2	1							1	1		1	3	2
	4	2								1	1		1	3	2
	5	2								1	1		1	3	2

SYLLABUS

UNIT-I **12L +3T**
Introduction to Reservoir Engineering: Basic Principles and Definitions – Porosity, Fluid saturation, Permeability, Flow through Layered Beds, Flow through Series Beds, Klinkenberg effect, Effective Permeability, Relative Permeability - Calculating Relative Permeability Data, Phase Behavior.

UNIT-II **12L + 3T**
Features of Reservoir: Reservoir Driving Mechanisms, Basic Equation and Tools, Volatile Oil Reservoirs, Identification of Volatile Oil Reservoirs, Ultimate Recovery, Predicting Reservoir Behavior, Rock Compressibility, Reservoir Heterogeneity.

UNIT-III **12L + 3T**

Material Balance of Oil Reservoirs: General Material Balance Equations, Reservoir Drive Mechanisms – Solution Gas, Gas cap, Natural Water, Compaction, Pore Compressibility Phenomena.

UNIT-IV **12L + 3T**

Pressure Maintenance in Reservoirs: Pressure Maintenance by Gas Injection, Condensing Gas Drive, Predicting Performance by Gas Injection, Injected Gas Drive Index, Pressure Maintenance by Water Injection, Predicting Performance by Water Injection, Index of Injected Water Drive, Control of The Gas Cap, Typical Water Injection Pressure Maintenance Operations.

UNIT-V **12L + 3T**

Enhanced Oil Recovery: Methods - Fluid Injection (Immiscible or Miscible Fluid Injection), Thermal Oil Recovery, Carbon Capture and Sequestration.

Textbook

1. Frank. W. Cole, *Reservoir Engineering Manual*, Gulf Publishing Company, Houston, Texas, Second Edition, 1989.

References

1. Ahmed, T,*Reservoir Engineering Handbook*, 3rd Edition, Elsevier, 2006.
2. Slip Slider, H.C. *Worldwide Practical Petroleum Reservoir Engineering Method*, PennWell Publishing Company, 1983.
3. Gianluigichierici, *Principles of Petroleum Reservoir Engineering*, Elsevier, 1994.
4. Dake. L. P., *Fundamentals of Reservoir Engineering*, Seventeenth Impression, Elsevier Science B. V., 1998

Web Resources

1. http://nptel.ac.in/courses/103105110/m3l16.pdf
2. https://www.class-central.com/tag/reservoir%20engineering

PROCESS OPTIMIZATION

CHE 422(B) **Credits:4**
Instruction : 4 Lectures& 1Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Prerequistes:
Engineering Mathematics

Course Objectives:
1. To learn problem formulation of optimization.
2. To realize the numerical methods of un-constrained optimization
3. To learn linear programming and its applications
4. To know the applications of numerical optimization in chemical engineering principles

Course Outcomes:
By the end of the course, the student will be able to:
1. Apply the knowledge of optimization to formulate the problems
2. Apply different methods of optimization and to suggest a technique for specific problem with a single variable
3. Apply different methods of optimization and to suggest a technique for specific problem with multivariable
4. Apply of simplex method for linear optimization problems
5. Understand how optimization can be used to solve the industrial problems of relevance to the chemical industry

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	2	2	2					1	1		1	3	2
	2	3	2	2	2					1	1		1	3	2
	3	3	2	2	2					1	1		1	3	2
	4	3	2	2	2					1	1		1	3	2
	5	3	2	2	2					1	1		1	3	2

SYLLABUS

UNIT-I **12L+ 3T**

Nature and organization of optimization problems: Introduction to optimization scope and hierarchy of optimization, examples of applications of optimization, essential features of optimization problems, general procedure for solving optimization problems, Optimization of a manufacturing problem with a stepwise procedure, obstacles of optimization.

Basic Concepts of Optimization:constraints in optimization, examples and formulation of constrained optimization problems. Basic concepts of optimization: Continuity of functions, unimodal versus Multimodel functions. Convex and Concave functions, Convex region, Necessary and sufficient conditions for an extremum of an unconstrained function

UNIT-II **12L+3T**

Optimization of unconstrained single variable functions: one-dimensional search: Numerical methods for optimizing a function of one variable, scanning and bracketing procedures, Newton's, Quasi-Newton's and Secant methods of unidimensional search Quadratic interpolation, Cubic interpolation. Applications of one- dimensional search methods to chemical engineering problems.

UNIT-III **12L+3T**

Unconstrained multivariable optimization: Random search methods, grid search, uni-variate search, multivariable Newton‘s method, Steepest descent method, Conjugate search directions, Conjugate gradient method, Powell‘s method.

UNIT-IV **12L+3T**

Linear programming and applications: Basic concepts in linear programming, DegenerateLP's – graphical solution, natural occurrence of linear constraints, standard LP form.Simplex method and applications.Simplex method to solve LP problems, duality principleand converting a LP to dual LP. Introduction to Genetic Algorithms (Qualitative Treatment only)

UNIT-V **12L+3T**

Optimization of UNIT operations: Optimal pipe diameter, minimum work of compression, Economic operation of a fixed bed filter, optimizing recovery of waste heat, optimization of multiple effect evaporator, optimization of flow rates in Liquid- Liquid extraction column, Determination of optimal reflux ratio for staged distillation column, Optimal residence time for maximum yield in an ideal isotherm batch reactor, Chemostat.

Text Books:

1. T.F. Edgar and D.M. Himmelblau, L.S. Lasdon, *Optimization of Chemical Processes,* McGraw-Hill, New York, 2001.
2. Kalyan Moy Deb,*Optimization for Engineering Design*, PHI Pvt. Ltd., New Delhi, 2000 Codes/Books **(UNIT-III)**

Reference Books:

1. S. S. Rao, *Engineering Optimization: Theory and Practice,* 3rdEd., John Wiley & Sons, 2009.
2. Dutta, Suman. *Optimization in Chemical Engineering*. Cambridge University Press, 2016.
3. Rangaiah, GadePandu. *Multi-objective optimization: techniques and applications in chemical engineering.* Vol. 1. World Scientific, 2009.
4. Nocedal, Jorge, and Stephen J. Wright. *Numerical optimization,* 2ndEd., 2006.
5. Joshi, Mohan C., and Kannan M. Moudgalya. *Optimization: theory and practice.* Alpha Science Int'l Ltd., 2004.

ENERGY ENGINEERING

CHE 422(C) **Credits: 4**
Instruction: 4 Lectures& 1Tut/Week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisites:
Chemical Technology, Engineering chemistry.

Course Objectives:
To provideknowledge to conventional and non-conventional energy resources and their applications, concept of fuel cells, nuclear energy, energy storage and conservation.

Course Outcomes:
By the end of the course, the student will be able to:
1. Explain the various conventional and non-conventional energy resources available, production and use.
2. Identify the scenario of oil and gases, characteristics and applications.
3. Discuss the sustainability in application of non-conventional energy resources
4. Elucidate the concept of fuel cells, biofuels and nuclear energy with future applications.
5. Substantiate the Energy Storage, Distribution and conservation methodology for sustainability.

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3					2			1	1		1	3	2
	2	3					2			1	1		1	3	2
	3	3					2			1	1		1	3	2
	4	3					2			1	1		1	3	2
	5	3					2			1	1		1	3	2

SYLLABUS

UNIT-I **12L+ 3T**
Introduction: Conventional energy resources, the present scenario, scope for future development.
Coal:Origin, occurrence and reserves, classification, ranking, analysis and testing, coal carbonization, manufacture of coke, coal gasification, coal liquefaction.

UNIT-II **12L+ 3T**
Oil and Gases: Origin and formation of petroleum and gases, reserves and deposits of world, Indian Petroleum Industry, Fractionation of petroleum.Fuels derived from oil and gases, Characteristics, production methods and uses.

UNIT-III **12L+ 3T**

Non-conventional energy sources: Solar energy, solar radiation, principles of heating and cooling, photo voltaic cells. Wind energy, hydrogen energy, geothermal and ocean thermal energy.

UNIT-IV **12L+ 3T**

Bio Fuels: Introduction, Bio mass conversion technologies, Wet processes, dry processes, Bio-gas generation, Factorsaffecting bio-digestion, Classification of biogas plants, Production methods, characteristics, uses of biodiesel,bio-ethanol, Second generation biofuel feed stocks.
Fuel Cells: Working principle, Types,Advantages, Current and Future Applications.
Nuclear Energy: Nuclear fuel processing, nuclear reactions and nuclear reactors.

UNIT-V **12L+ 3T**

Energy Storage and Distribution: Mechanical Energy Storage, Hydroelectric Storage, Compressed Air Storage and Energy Storage via Flywheels,Electric Storage, Chemical Storageand Thermal Energy Storage.
Energy Conservation: Conservation methods in process industries, Theoretical analysis, practical limitations, equipment for energy saving / recovery.

Text Books:

1. S. Rao, B. B. Parulekar,*Energy Technology*, 3rd Ed., Khanna Publishers, 1994. **(UNIT-I &V)**
2. G. D. Rai,*Non-Conventional energy sources*, 18thEd.,Khanna Publisher, 2017.**(UNIT-III)**
3. S. Sarkar,*Fuels and Combustion*, Universities Press, 3rdEd., 2009.**(UNIT-IV)**
4. Nelson. W. L,*Petroleum refining Engineering*, 4thEd.,McGraw Hill, New York, 1969.**(UNIT-II)**

Reference books:

1. S.B.Pandy,*Conventional Energy Technology*, Tata McGraw Hill.
2. S. Srinivasan,*FuelCells: From Fundamentals to Applications*, Springer, 2006 .
3. O. P. Gupta,*Fundamentals of Nuclear power reactors*, Khanna Publishers, New Delhi, 1983.
4. Harker and Backhusst,*Fuels and energy,* Academic press, London 1981.

INDUSTRIAL MANAGEMENT

CHE 422(D) **Credits:4**
Instruction : 4 Lectures /Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Course Objectives

1. To familiarize the students with the concepts of Management.
2. To relate the concepts of management with industrial organizations.
3. To explain the factors affecting productivity and how productivity can be increased in anIndustrial undertaking.

Course Outcomes:

By the end of the course, the student will be able to:

1. Understand the concepts of Management
2. Gain basic understanding of management and to relate the concepts of management with industrial organizations and manage organizations efficiently
3. Have the basic knowledge of production management and make decisions proficiently
4. Have the knowledge in maintaining better human relations in the organizations

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2								1	1	2	1	1	1
	2	2							1	1	3		1	1	1
	3	2								1	1		1	1	1
	4	2								1	1	1	1	1	1

SYLLABUS

UNIT-I **12L+ 3T**

Management: Functions of management – Planning, Organizing, Staffing, Directing Controlling and Coordinating, Levels of management, Role of Manager, Skills of manager, – F.W. Taylor's scientific management and Henry Fayol's principles of management.

UNIT-II **12L+ 3T**

Organization: Meaning of Organization, Principles of organization, Departmentalization, Organization structure (in brief),

Communication: Importance, purpose and forms of communication. Barriers to communication.

UNIT-III **12L+ 3T**

Forms of business organizations: Salient features of Sole proprietorship, Partnership, Joint Stock Company, Private limited company and Public limited company, Government enterprises and Co-operative societies.

UNIT-IV **12L+ 3T**

Production operations management: Production planning and control, Plant location and factors affecting plant location, Plant layout and types of layout (in brief).

UNIT-V **12L+ 3T**

Human Resources Management: Basic functions of human resource management. Manpower planning, Recruitment, Selection, Training and Development, Placement, Compensation and Performance appraisal.

Text Books

1. P.C. Tripathi, P.N.Reddy, *Principles of Management*, 4th Edition, Tata McGraw Hill Companies, New Delhi ,2008.**(UNITI & II)**
2. A.R. AryaSri, *Managerial Economics and Financial Analysis*, TMH Publications, NewDelhi, 2014.**(UNIT III)**
3. S.C. Sharma and Banga T. R., *Industrial Organization & Engineering Economics*, khanna Publications, Delhi-6, 2006.**(UNIT IV & V)**

Reference Books:

1. O.P. Khanna,*Industrial Engineering and Management*, Dhanpat Raj and Sons.

BIOCHEMICAL ENGINEERING

CHE 422(E) | **Credits:4**

Instruction : 4 Lectures& 1Tut/Week | Sessional Marks : 40

End Exam : 3 Hours | End Exam Marks: 60

Course Objectives:

1. To enhance interdisciplinary skills
2. To understand basic concept of life sciences
3. To have knowledge on different bioreactors and their design
4. To have knowledge on production of different bioproducts and their analytical procedures

Course Outcomes:

By the end of the course, the student will be able to:

1. Distinguish various microorganisms and biomolecules
2. Classify different enzymes and its kinetics
3. Design various bioreactors
4. Model various transport phenomena mechanisms
5. Describe theproduction of biomolecules and its quantification

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3					1	1		1	1		1	3	2
	2	3	1	1	1					1	1		1	3	2
	3	3	2	2	2					1	1		1	3	2
	4	3	2	2	2					1	1		1	3	2
	5	3	1	1	1					1	1		1	3	2

SYLLABUS

UNIT-I **12L+3T**

Introductionto biochemical engineering: Comparison of chemical and biochemical processes, industrially important microbial strains used for different bio products

Chemicals of life: Carbohydrates, proteins, lipids, nucleic acids, their classification and biological functions

Biology of microbes: Protist kingdom, classification and structure of different cells

UNIT-II **12L+3T**

Introduction to enzymes: Classification, kinetics of enzyme catalyzed reactions, derivation of MichaelisMenten equation for single substrate, determination of M.M parameters, enzyme inhibition – types, immobilization of enzymes, methods, immobilized enzyme kinetics, applications of immobilized enzymes and soluble enzymes

UNIT-III **12L+3T**

Kinetics of cell growth: Growth phases, yield coefficient, Monod growth kinetics, ideal bioreactors – batch –mixed flow and plug flow reactors,chemostat with recycle and their analyses

UNIT-IV **12L + 3T**

Transport phenomenonacross the cell: Active, passive and facilitated diffusion, gas liquid mass transfer in cellular systems, determination of $k_L a$values

Sterilization: Media and air, methods of continuous sterilization of media

UNIT-V **12L + 3T**

Downstream processing: Special reference to membrane separation and chromatographic techniques like Gas chromatography, thin layer and paper chromatography, HPLC, affinity, gel, adsorption and ion exchange chromatography.

Important industrial bio products: ethanol – penicillin – citric acid – acetic acid, effluent treatment, production of biogas.

Text Book:

1. M.L.Shuler and F.Kargi,*Bioprocess Engineering: Basic Concepts,* 2nd edition, Prentice Hall India, New Delhi, 2003

Reference Books:

1. J.E.Bailey and D.F.Ollis,*Biochemical Engineering Fundamentals,* 2nd edition,McGraw-Hill Publishers, Newyork, 1986
2. D.G. Rao, *Biochemical engineering,* Tata McGraw-Hill Publishers, New Delhi
3. J.M. Lee, *Biochemical engineering,* Prentice Hall, Englewood Clifts, 1992.

CHEMICAL PROCESS EQUIPMENT DESIGN LABORATORY
(Open book practical examination)

CHE 423 | **Credits: 2**
Instruction: 3 practical hours/Week | Sessional Marks: 50
End Exam: 3 Hours | End Exam Marks: 50

Prerequisites:
Heat Transfer, Mass Transfer, and chemical Reaction Engineering.

Course Objectives:
To provide the knowledge on design of different equipments.

Course Outcomes:
By the end of the course, the student would be able to
1 Design heat transfer equipment
2 Design reactor and mass transfer equipment

CO – PO – PSO Matrix:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	3	3					2	2		1	2	3
	2	3	3	3	3					2	2		1	2	3

The following equipments are to be designed in detail:

1. Double pipe heat exchanger
2. Double pipe heat exchanger in series-parallel arrangements
3. 1-2 Shell and Tube heat exchanger
4. 2-4 Shell and Tube heat exchanger
5. Condenser and reboiler
6. Multiple effect feed forward evaporator
7. Multiple effect feed backward evaporator
8. Fractionating column-Plate and packed columns
9. Packed bed absorber
10. Continuous tubular reactor (homogeneous and heterogeneous)

Two equipment designs can be performed in simulation software to have hands on experience

Prescribed Books:
1. Donald Q Kern, *Process Heat Transfer,* McGrawHill International Book Company, 1983.
2. Robert ETreybal, *Mass Transfer Operations*, 3rd Edition, McGraw Hill International Book Company, 1980

PROJECT WORK

CHE 424 **Credits: 8**
Instruction: 6 practical hours/Week Sessional Marks: 100
End Exam: 3 Hours End Exam Marks: 100

Course Objectives:

To prepare students to conduct, design and analyze the problems of Chemical Engineering through experimental or theoretical studies and represent in the form of technical report.

Course Outcomes:

By the end of the course, the student would be able to

1. Identify the gap between the needs of society and available technology through literature survey
2. Formulate and analyze the objectives of their study
3. Aggregate research in the form of a written report

CO – PO – PSO Matrix:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3	1	1	1	1	1	1	3	3	1	3	3	3
	2	3	3	3	3	3	2	2	2	3	3	3	3	3	3
	3	3	1	1	1	1			3	3	3	1	3	3	3

Project Identification Strategies Projects are classified into three categories

- Theoretical design projects
- Experimental projects
- Simulation projects

The project work should consist of a comprehensive design of a chemical plant in the form of a report with the following chapters.

1. Introduction
2. Physical and chemical properties and uses
3. Literature survey for different processes
4. Selection of the process
5. Material and energy balances
6. Specific equipment design (Process as well as mechanical design with drawings)
7. General equipment specifications
8. Plant location and layout
9. Materials of construction
10. Health and safety factors
11. Preliminary cost estimation
12. Bibliography

Project Evaluation:

The student projects have been evaluated by three internal evaluators and also by the project guide. The project is divided into six parts as follows

- Introduction of the project
- Process description with flow sheet
- Material and Energy balances
- Design of specific equipment
- Plan location, layout and economics
- Over all project

Project seminars are conducted in six phases to evaluate the progress of project work carried. For each presentation 50 marks are allotted to each student by the four evaluators (guide 20M and each examiner 10M). Marks have been awarded based on the performance of the student in terms of presentation skills, communication skills, knowledge on the project,finally all the marks obtained in the six phases are averaged to award total marks for the project

BUILDING TECHNOLOGY

CIV 114 **Credits : 3**

Instruction : 2 Lecture & 1 Tutorial / week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks : 60

Course Objectives:

The objective of the course is to prepare the student to

- Learn about building byelaws laid by planning authorities
- Understand about masonry types in brick and stone construction
- Learn about building components and foundations

Course Outcomes:

At the end of the course the student will be able to

1. Suggest the suitability of stones, bricks and timber based on their characteristics.
2. Identify the various types of metals, glasses& plastics.
3. Learn about masonry types in brick and stone construction and their application in construction of various building components.
4. Understand about Building components like Floors, Floor & surface finishes (Painting & distempering).
5. Learn about various types of foundation and importance of formwork & scaffolding.

Mapping of course outcomes with program outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**		2		2		2	2				1	1	2	2	2
	2		2				2	2				1	1	2		2
	3					1	2	2				1	1			2
	4					2	2	2				1	1		2	2
	5					2	2	2				1	1		2	2

SYLLABUS

UNIT - I 12 Periods

Stones: Quarrying & dressing of stones; Characteristics of good building stones, Common building stones, Uses in Civil Engineering.

Employability

Clay Bricks: Ingredients of good brick earth; Harmful substances, Additives; Manufacture of bricks (IS: 2117); Characteristics of good bricks; Classification of bricks; defects of bricks; Tests on bricks: compressive strength, water absorption, Efflorescence (IS: 3495); Uses of bricks

Employability

Timber: Characteristics of good timber; defects in timber, Decay of timber, Seasoning and preservation, properties, uses of timber; Commercial forms of timber products in Civil Engineering.

UNIT - II 12 Periods

Metals: Ferrous metals: Properties & uses of different types of iron; non-ferrous metals: Aluminium & Lead, properties, uses in civil engineering

Employability

Glass: Classification & Commercial forms of glasses, uses in civil engineering

Plastics: Types of plastics, properties, uses in civil engineering, Fibre glass Reinforced plastics, Properties & Applications.

Employability

Employability

UNIT – III 12 Periods

Stone Masonry: Classification of walls; Technical terms - Stone masonry construction - types and rules- Arches and lintels

Stone Masonry: Brick masonry walls - bonds and rules - cavity wall construction - Hollow concrete block masonry - Lightweight wall construction - Prefabricated brick panel for walls – reinforced masonry - composite masonry

UNIT - IV 12 Periods

Employability

Floors: Terminology; Materials – Types of floors – suitability (Industrial, Indoor, and Stilt & Terrace Floors) and construction; Concrete, mosaic, terrazzo, tiled, stone & synthetic floors and floor finish

Employability

Surface Finishes: Plastering - Pointing - Paints: Characteristics of good paint; Ingredients of oil-borne paint; Types of paints; Defects in painting;

Employability

Distempers: Properties & ingredients; Process of distempering; Wall Paper; White wash; Colour wash.Pebble dash – Dado/Skirting, Tiles etc.

UNIT - V 12 Periods

Foundations: Need for foundation - types of foundation - open foundation - Shallow foundations – Spread, combined- strap and raft foundation - deep foundations - pile foundation - well foundations and caissons - Factors affecting selection of foundations; setting out of foundations - excavations for foundation trenches and base.

Form Work, Scaffolding: Form work, Types of formwork; Centering - scaffolding - Types of scaffolding.

Employability

TEXT BOOKS

1. Rangwala, Engineering Materials, 41st Edition: 2014, Charotar Publishing House Pvt. Ltd.
2. The Text Book Of Building Construction by S.P. Arora, S.P. Bindra, Dhanpatrai Publications.
3. Building Construction by B.C. Punmia, Laxmi Publications (p) Ltd.

REFERENCES

1. S.K.Duggal, Building Materials, New Age International Publishers
2. D.N. Ghose, Materials of construction, Tata-McGraw-Hill Publishing Company Limited.
3. National Building Code of India, SP 7 (1): 1983, First Revision 1992, Bureau of Indian Standards
4. Building Construction by Sushil Kumar, Standard publishers' distributors
5. Relevant NPTEL Courses.

ENGINEERING GEOLOGY

Course Code - Category: CIV 123 - PC **Credits:3**

L	T	P	E	O
2	0	1	1	2

End Exam: 3 Hours

Sessional Marks:40

End Exam Marks:60

Course Objectives:

The objective of the course is to prepare the students

1. To identify & classify different minerals and map the geological structures present in subsurface.
2. Investigate the selected project site to obtain data and determine the favourable considerations in study area.
3. Measure earthquakes and landslides to classify the hazardous zones and interpret geological maps.

Course Outcomes:

CO1	Classify different branches of Geology and understand the concept weathering.
CO2	Identify and classify different rocks and soils based on their geological genesis.
CO3	Identify and classify the minerals and geological structuresof different types of rocks based on their geological genesis.
CO3	Identify and classify the minerals and geological structuresof different types of rocks based on their geological genesis.
CO4	Analysethe ground conditions through geophysical exploration and interpret from available data to determine the favourable geological considerations (i.e., Lithological structural and ground water) in the study area for theconstruction civil engineering projects.
CO5	Understand the concepts and importance of study of earthquakes, landslides & tsunamis.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1					1	2			1		1	1		2
	2	1					1	2			1		1	1		2
	3	1					1	2			1		1	1		2
	4	2	1	1			1	2			1	1	1	1		2
	5	1				1	1	1			1		1	1		1

SYLLABUS

UNIT - I **12 Periods**

Introduction: Definition of Geology and Engineering Geology, Branches of Geology, Scope and importance of geology from Civil Engineering point of view.Brief study of case histories of failure of some civil engineering constructions due to geological draw backs. Role of engineering geologist in planning, design and construction stages in Civil Engineering works

Earth: Internal structure of the Earth and its composition, Elementary knowledge on isostasy, continental drift, plate tectonics and sea floor spreading.

Geological Cycle: Weathering, Effect of Weathering over the properties of rocks, Importance of Weathering with reference to civil engineering constructions like dams, reservoirs and tunnels.

Learning outcomes:
At the end of this unit the student will be able to

- **Enumerate** various branches of Geology
- **Understand** elementary knowledge on isostasy
- **Comprehend** the concept of weathering and its effects

UNIT - II **12 Periods**

Employability

Petrology: Definition of rock, Civil Engineering importance – Geological classification of rocks –Rock cycle, Formation, Structure, texture and mineralogical composition of igneous, sedimentary and metamorphic rocks, Study of physical properties of different types of igneous, sedimentary and metamorphic rocks. Igneous rocks: Granite, synite, dolerite, gabro, diorite, basalt. Sedimentary rocks, dykes and sills: Breccia, conglomerate, Sandstone, Shale, limestone. Metamorphic rocks: Gneiss, khondalite, schist, slate, marble, quartzite, charnokite. Engineering properties of rocks.

Soils: Soil formation, Soil profile, – Geological classification – Engineering classification and description of Indian soils; Soil erosion and conservation.

Learning outcomes:
At the end of this unit the student will be able to

- **Explain** the rock cycle
- **Identify** the properties of various rocks
- **Comprehend** the process of soil formation

UNIT - III **12 Periods**

Minerology: Definition of mineral, Importance of study of minerals, Different methods of study of minerals, Study of physical properties of different rock forming minerals: Silicate structures, Quartz, feldspars, pyroxenes, amphiboles, micas and clays, Introductory knowledge on Chemical and optical properties of minerals.

Structural Geology: Elements of structural geology:Strike, dip, outcrop, plunge – Study of folds, faults, joints, unconformities, Classification of folds, faults and joints. and their importance in Civil Engineering works.

Learning outcomes:
At the end of this unit the student will be able to

- **Understand** the importance of minerology
- **Gain** elementary knowledge on chemical and optical properties of minerals
- **Depict** the structural geology and their classifications

UNIT - IV **12 Periods**

Geophysical Exploration: Electrical, Seismic, Gravity and Magnetic methods. Principle of Resistivity method and configurations. Principles of Seismic refraction and reflections methods.

Geological Applications in Civil Engineering: Geological investigations for Civil Engineering Projects. Favourable Geological considerations for construction of Dams, Reservoir, Tunnels and Road Cuttings. Underground water in relation to Engineering Works.

Learning outcomes:
At the end of this unit the student will be able to

- **Conduct** geophysical exploration methods for sub-surface exploration.
- **Understand** the importance of Geological applications in civil engineering

UNIT - V **12 Periods**

Earthquakes: Terminology, Causes and effects, Classification, Earthquake waves, Seismograph, Locating Epicenter, Determination of depth of focus, Intensity, Magnitude, Mercalli & Richter scales, Prediction, Effects, Seismic belts, Shield areas – Seismic zones of India – Civil Engineering considerations in seismic areas – Precautions of building constructions in seismic areas. Safety measures for buildings and dams – Reservoir induced seismicity.

Landslides: Causes, effects, methods of mitigating impact of landslides.

Tsunamis: Meaning of Tsunami, causes & Effects of Tsunami, warning and mitigation.

Learning outcomes:
At the end of this unit the student will be able to

- **Understand**the concept of earthquakes, landslides and tsunamis.
- **Classify**the earthquake zones based seismic activity

TEXT BOOKS

1. **D.Venkata Reddy "***Engineering Geology"* Vikas Publishing House Pvt Ltd. 2011.
2. **N.ChennaKesavulu** "*Text book of Engineering Geology"* MacMillan India Ltd, Hyderabad, 2014

REFERENCES

1. **SubinoyGangopadhyay** "*Engineering Geology"* Oxford University Press. 2013.
2. **F.G. Bell** "*Fundamental of Engineering Geology*" Butterworth Publications, New Delhi, 1992.
3. **David George Price** *Engineering Geology Principles and Practice* Springer, 2009.
4. **KVGK Gokhale** *"Principles of Engineering Geology*" B.S.Publications-2005
5. **Parbin Singh, K Kataria& Sons** *Engineering and General Geology*, New Delhi, 2009
6. **P.C. Varghese** *"Engineering Geology for Civil Engineers"*, PHI learning pvt. Ltd., 2012

Relevant NPTEL Courses.

ENGINEERING MECHANICS

Course Code - Category : CIV 124 - ES **Credits:3**

L	**T**	**P**	**E**	**O**	
2	**1**	**0**	**1**	**4**	Sessional Marks:40
End Exam: 3 Hours					End Exam Marks:60

Course Objectives:

The objective of the course is to enable the student

- To develop logical thinking approach to engineering problems.
- Learn about the basic concepts of force, moment, resultant forces.
- Learn aboutcentroid&centre of gravity, static analysis of simple plane trusses, area moment of inertia,

Course Outcomes:

By the end of the course, student will be able to:	
CO1	Analyze a given physical problem into a suitable forces and moments.
CO2	Identify the centroid of a given plane area and find its area/ mass moment of inertia
CO3	Apply the concept of friction to simple engineering problems
CO4	Calculate the displacement, velocity and acceleration of a moving particle
CO5	Apply the work-energy, D ALEMBERTS principle to particles and connected systems

Mapping of course outcomes with program outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	2	1									3	1	
	2	3	2	1	1									2	1	
	3	3	3		2									3	2	
	4	3	3	2	2								1	3	2	
	5	3	3	2	2								1	3	2	

SYLLABUS

UNIT – I **12 Periods**

Basic Concepts: Introduction to Engineering Mechanics – Scalar and Vector quantities – Forces – Characteristics of a force – Definitions and examples of various types of force systems – Definition of resultant – Composition and resolution of forces – Moment of a force – Principles of moments of force – Couples – characteristics of a couple – on Transformations of a couple – Resolution of a force into a force and couple. Resultants of Force Systems, possible resultants of different types of force systems.

Skill Development

UNIT – II **12 Periods**

Equilibrium Analysis: Free body diagrams – Equations of equilibrium for a concurrent coplanar force system – Equilibrium of Bodies acted on by two or three forces – Equilibrium of bodies acted on by non-concurrent coplanar force system – Equilibrium of bodies acted on by parallel, non-coplanar force system – Equilibrium of non-concurrent, non-coplanar non-parallel force system.

Skill Development

Analysis of trusses:Method of joints,Method of sections and tension coefficient method.

UNIT – III **12 Periods**

Friction: Nature of friction – Laws of friction – Coefficient of friction – Angle of friction – Cone of friction – Problems involving frictional forces – Frictional forces on flexible bands and belts – Rolling friction – Thrust bearing.

Centroid and Centre of Gravity: Centre of gravity of parallel forces in a plane – Centre of gravity of parallel forces in space – centroids and centres of gravity of composite bodies – Theorems of Pappus.

Skill Development

UNIT – IV **12 Periods**

Moments of Inertia: Definition – Parallel axis theorm for areas – Second moments of areas by integration – Radius of gyration of areas – Moments of inertia of composite areas.

Skill Development

Kinematics: Absolute Motion: Introduction –basic terminology of mechanics – Newton's Laws – Introduction to Kinematics of Absolute Motion – Rectilinear motion of a particle – Angular motion of a line.

UNIT – V **12 Periods**

Kinetics: Introduction to kinetics – Force, mass and acceleration approach, Newton's laws of motion - D Alembert's principle – Work - Energy principle – Work done by a force – Work done by a varying force – Work done by a force system – Energy – Power –Work Energy equation for translation – Work done by a Spring – Principle of conservation of energy.

TEXT BOOKS

1. **SS Bavikatti and Rajasekharappa** "*Engineering Mechanics"* New Age International Pvt. Ltd.
2. **I.B. Prasad "***Applied Mechanics*" by Khanna Publishers.

REFERENCES

1. **S. Timoshenko and D.H. Young** "*Engineering Mechanics*" Pearson Prentice publication.
2. **Basudeb Bhattacharyya**, "*Engineering Mechanics*" Oxford University Press.
3. **F.L. Singer** "*Engineering Mechanics*" Harper Collins Publishers.

4. **E. Nelson, Charles Best, W.G. McLean, Merle Potter** "*Schaum's outline of Engineering Mechanics: Statics"*
5. **F.P. Beer and E.R. JhonstonJr** "*Vector Mechanics & Statics"* McGraw Hill.
6. **J.L. Meriam and L.G. Kraige "**Engineering Mechanics: Statics" Wiley India Ltd.
7. Relevant NPTEL Courses.

ENGINEERING MATHEMATICS - III

CIV 211 **Credits : 4**
Instruction : 3 Lecture & 1 Tutorial / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Outcomes:

At the end of the course the student will be able to

1. Understand the concepts of Gradient, Divergence and Curl and finding scalar potential function of irrotational vector fields.
2. Understand the concepts of Green's Theorem, Stokes' Theorem and the Divergence Theorem and to evaluate line integrals, surface, integrals and flux integrals.
3. Understand some basic techniques for solving linear partial differential equations and how to identify a partial differential equation in order to determine which technique(s) can best be applied to solve it.
4. Understand the methods to solve the Laplace, heat, and wave equations.
5. Gain good knowledge in the application of Fourier Transforms.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	3	3							2	1	3	3	
	2	3	2	2	2									3	2	
	3		2	2	3							3	1	2	3	
	4		3	2								3		3		
	5		3	2								3		3		

SYLLABUS

UNIT - I 12 Periods

Vector Differentiation: Differentiation of Vectors – Scalar and Vector point function – Del applied to Scalar point functions - Gradient geometrical interpretations – Directional Derivative - Del applied to vector point function – divergence - Curl – Physical interpretation of Divergence and Curl - Del applied twice to point functions- Del applied to product of point functions.

UNIT – II 12 Periods

Vector Integration: Integration of vectors – Line integral – Surface – Green's theorem in the plane – Stokes theorem – Volume integral – Gauss Divergence theorem (all theorems without proofs) – Irrotational fields.

UNIT - III 12 Periods

Partial Differential Equations: Introduction – Formation of Partial Differential Equations – Solution of Partial Differential Equations – Equations solvable by Direct Integration– Linear Equations of First order -Homogeneous Linear Equations with Constant Co-efficient – Rules for finding the complementary function - Rules for finding the Particular integral – Non-Homogeneous linear equations.

UNIT - IV 12 Periods

Application of Partial Differential Equations: Introduction – Method of separation of variables – Vibrations of a stretched string- Wave equation – One dimensional Heat flow - Two dimensional Heat flow – Solution of Laplace's equation.- Laplace's equation in Polar Co-ordinates.

UNIT - V 12 Periods

Fourier Transforms: Introduction – definition – Fourier integral theorem - Fourier sine and cosine integrals – Complex form of Fourier integrals – Fourier integral representation of a function – Fourier Transforms – Properties of Fourier Transforms – Convolution Theorem – Parseval's identity for Fourier transforms – Fourier Transforms of the Derivatives of functions – Application of Transforms to Boundary value problems – Vibrations of a string.

TEXT BOOKS

1. Dr. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, New Dehli.

REFERENCES

1. A Text book on Engineering Mathematics by N.P. Bali Etal, Laxmi pub.(p)Ltd.
2. Advanced. Engineering Mathematics by H.K.Dass
3. Advanced Engineering Mathematics by Erwin kreyszig.
4. Higher Engineering Mathematics by Dr.M.K. Venkataraman, National Pub.Co.Madras.
5. Relevant NPTEL Courses.

BUILDING TECHNOLOGY

CIV 212 | **Credits : 3**

Instruction : 3 Lecture & 1 Tutorial / week | Sessional Marks : 40

End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

The objective of the course is to prepare the student to

1. Learn about building byelaws laid by planning authorities
2. Understand about masonry types in brick and stone construction
3. Learn about building components and foundations

Course Outcomes:

At the end of the course the student will be able to

1. Know the various building Bye-Laws laid by town planning authorities and local regulatory bodies for Planning various buildings like residential, educational, office buildings and hospital buildings.
2. Learn about masonry types in brick and stone construction
3. Understand about various Building components.
4. Learn about various types of foundation.
5. Know about damp prevention and fire protection methods.
6. Understand about various types of roofs.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	3			3	3	3			2	1	3		3
	2	3	2	2										3		3
	3		2	2			3	3				3	1	2		3
	4		3	2			3	3	2			3		3		3
	5	3	2	2										3		3
	6		2	2			3	3				3	1	2		3

SYLLABUS

UNIT - I 12 Periods

Introduction: Component Parts of a Building - Load bearing construction - Framed buildings - Tall buildings, Advantages, problems - Other types of Buildings - Setting and laying out a building - Responsibilities and Duties of the Client and Engineer.

Employability

Walls: Classification of walls; Technical terms - Stone masonry construction - types and rules - Brick masonry walls - bonds and rules - cavity wall construction - Hollow concrete block masonry - Light weight wall construction - Prefabricated brick panel for walls – reinforced masonry - composite masonry - Arches and lintels

UNIT - II 12 Periods

Doors, Windows and Ventilators: Location of doors and windows, technical terms, Dimensions of doors and windows, Door frames, Types of doors and windows, Ventilators, Fixtures and fastenings.

Employability

Building Conveyance Verticality: Stair cases - Lifts - Escalators - Ramps - Basic terms - Types - Design considerations – Maintenance

UNIT - III 12 Periods

Floors: Terminology; Materials – Types of floors – suitability (Industrial, Indoor, Stilt & Terrace Floors) and construction; Concrete, mosaic, terrazzo, tiled, stone & synthetic floors and floor finish.

Roofs: Terminology; Classification of roofs - Steel sloping roofs - Roof covering materials - Types of flat roofs - Basic roofing elements - Roof coverings - Pitched, flat and curved roofs - Lean–to–roof - couple roofs, trussed roofs - roof drainage - roof cladding materials and their fixtures. Flat roofs: RCC roofs.

Surface Finishes: Plastering - Pointing - White washing - distempering – Painting - Pebble dash – Dado/Skirting, Tiles etc.

UNIT - IV 12 Periods

Foundations: Need for foundation - types of foundation - open foundation - Shallow foundations – Spread, combined- strap and raft foundation - deep foundations - pile foundation - well foundations and caissons - Factors affecting selection of foundations Foundation on black cotton soils; setting out of foundations - excavations for foundation trenches and base - general principles of dewatering foundation excavations - coffer dams.

Form Work, Scaffolding: Form work, Types of formwork; Centering - scaffolding - Types of scaffolding.

UNIT - V 12 Periods

Construction safety: safety in construction - general requirements - common hazards during excavation; piling and other deep foundations - common hazards during walling; roofing; additional safety requirements for erection of concrete framed structures - additional safety requirements for erection of structural steel work - general requirements; safety in demolition of buildings

Employability

Introduction to Green Buildings: Introduction - Necessity - Concept of Green building. Principles of green building - Selection of site and Orientation of the building - usage of low energy materials - effective cooling and heating systems - effective electrical systems - effective water conservation systems - Certification systems - GRIHA and LEED - case studies

TEXT BOOKS

1. The Text Book Of Building Construction by S.P.Arora, S.P.Bindra, Dhanpatrai Publications.
2. Building Construction by B.C. Punmia, Laxmi Publications (p) Ltd.

REFERENCES

1. TERI *"Sustainable Building Design Manual- Volume I & II"* Tata Energy Research Institute.
2. National Building Code of India, SP 7 (1): 1983, First Revision 1992, Bureau of Indian Standards
3. Building Construction by Sushil kumar, Standard publishers distributors.
4. Building construction by P.C.Verghese, PHI Learning (P) Ltd.
5. Building Construction, Vol.II & III By W.B. Mckay, E.L.B.S. and Longman, London, U.K.
6. Green Building Design, Construction and Operations, Sustainable Building Technical Manual, U.S.Green Building Council, 1996, Public technology Inc.
7. Relevant NPTEL Courses.

ENGINEERING GEOLOGY

CIV 213 | **Credits : 3**
Instruction : 3 Lecture & 1 Practical / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

The objective of the course is to prepare the students

1. To identify & classify different minerals and map the geological structures present in subsurface.
2. Investigate the selected project site to obtain data and determine the favourable considerations in study area.
3. Measure earthquakes and landslides to classify the hazardous zones and interpret geological maps.

Course Outcomes:

At the end of the course the student will be able to

1. Identify and classify the different minerals and rocks based on their physical properties and geological genesis
2. Map the various geological structures present in the subsurface and their importance in the study of natural hazards like earthquakes etc.
3. Apply the different investigation techniques from initial stage to final stage for the selection of proper project site.
4. Do the interpretation of available data to determine the favorable geological considerations (i.e., Lithological structural and ground water) in the study area for the construction of different civil engineering projects dams etc.
5. Classify and measure the earthquake, Landslides and subsidence prone areas to practice the hazard zonation.
6. Prepare, analyze and interpret the Engineering Geologic maps.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1		1	1	2	1	2	2	1		1			1	2	2
	2	1	2	1	2		1	2			1			2	2	2
	3		2	1	2	2	2	2	1		2			2	2	2
	4	1	3	1	2	1	2	2	1		2			2	2	2
	5	1				2	2	1	1		1			1	2	2
	6		1	1	2	1	2	2	1		1			1	2	2

SYLLABUS

UNIT - I 12 Periods

Introduction: Definition of Geology and Engineering Geology, Branches of Geology, Scope and importance of geology from Civil Engineering point of view. Brief study of case histories of failure of some civil engineering constructions due to geological draw backs. Role of engineering geologist in planning, design and construction stages in Civil Engineering works

Earth: Solar System, Origin of the Earth, Internal structure of the Earth and its composition, Elementary knowledge on isostasy, continental drift, plate tectonics and sea floor spreading.

Geological Cycle: Weathering, Effect of Weathering over the properties of rocks, Importance of Weathering with reference to civil engineering constructions like dams, reservoirs and tunnels-Land forms produced by, running water, and glaciers. Land forms produced by wind, sea waves and currents.

UNIT - II 12 Periods

Petrology: Definition of rock, Civil Engineering importance – Geological classification of rocks –Rock cycle, Formation, Structure, texture and mineralogical composition of igneous, sedimentary and metamorphic rocks, Study of physical properties of different types of igneous, sedimentary and metamorphic rocks. Igneous rocks: Granite, synite, dolerite, gabro, diorite, basalt. Sedimentary rocks, dykes and sills: Breccia, conglomerate, Sandstone, Shale, limestone. Metamorphic rocks: Gneiss, khondalite, schist, slate, marble, quartzite, charnokite. Engineering properties of rocks.

Soils: Soil formation, Soil profile, – Geological classification – Engineering classification and description of Indian soils; Soil erosion and conservation.

Employability

UNIT - III 12 Periods

Minerology: Definition of mineral, Importance of study of minerals, Different methods of study of minerals, Study of physical properties of different rock forming minerals: Silicate structures, Quartz, feldspars, pyroxenes, amphiboles, micas and clays, Introductory knowledge on Chemical and optical properties of minerals.

Employability

Structural Geology: Elements of structural geology: Strike, dip, outcrop, plunge – Study of folds, faults, joints, unconformities, Classification of folds, faults and joints. and their importance in Civil Engineering works. Potential problems from rock structures in engineering constructions, Treatment of rocks by grouting.

Employability

UNIT - IV 12 Periods

Geophysical Exploration: Principles of geophysical methods, Electrical, Seismic, Gravity and Magnetic methods. Principle of Resistivity method and configurations. Applications of Resistivity method in prediction of soil profile, hard rock and ground water table. Principles of Seismic refraction and reflections methods and their applications to Civil Engineering problems.

Geological Applications in Civil Engineering: Geological investigations for dams and reservoirs. Case histories of dam failures and their causes. Geology of the major dam sites of India. Factors affecting the seepage and leakage of reservoir and the remedial measures. Geological investigations for bridges and Multi- storied structures. Geological investigations for highways, railways, canals, runways, powerhouses, power channels and flumes.

Geological investigations for tunnels and coastal structures (Seawalls, groins and bulkheads); Environmental geology. Coastal Management, Underground water in relation to Engineering Works.

UNIT - V 12 Periods

Earthquakes: Terminology, Causes and effects, Classification, Earthquake waves, Seismograph, Locating Epicenter, Determination of depth of focus, Intensity, Magnitude, Mercalli & Richter scales, Prediction, Effects, Seismic belts, Shield areas – Seismic zones of India – Civil Engineering considerations in seismic areas – Precautions of building constructions in seismic areas. Safety measures for buildings and dams – Reservoir induced seismicity.

Landslides: Causes, effects, methods of mitigating impact of landslides.

Employability

Tsunamis: Meaning of Tsunami, causes & Effects of Tsunami, warning and mitigation.

Employability

TEXT BOOKS

1. Engineering Geology by D.Venkata Reddy, Vikas Publishing House Pvt Ltd. 2011.
2. Text book of Engineering Geology, by N.Chenna Kesavulu, MacMillan India Ltd, Hyderabad, 2014

REFERENCES

1. Engineering Geology by Subinoy Gangopadhyay, Oxford University Press. 2013.
2. Fundamental of Engineering Geology by F.G. Bell, Butterworth Publications, New Delhi, 1992.
3. Engineering Geology: Principles and Practice by David George Price, Springer, 2009.
4. Principles of Engineering Geology by KVGK Gokhale. B.S.Publications-2005
5. Engineering and General Geology by Parbin Singh, K Kataria & Sons, New Delhi, 2009
6. Engineering Geology for Civil Engineers by P.C. Varghese, PHI learning pvt. Ltd., 2012
7. Relevant NPTEL Courses.

ENGINEERING MECHANICS

CIV 214 | **Credits : 3**

Instruction : 3 Lecture & 1 Tutorial / week | Sessional Marks : 40

End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

The objective of the course is to enable the student

1. To develop logical thinking approach to engineering problems.
2. Learn about the basic concepts of force, moment, resultant forces.
3. Learn about centroid & centre of gravity, static analysis of simple plane trusses, area moment of inertia,

Course Outcomes:

At the end of the course the student will be able to

1. Analyze a given physical problem into a suitable forces and moments.
2. Identify the centroid of a given plane area and find its area/ mass moment of inertia.
3. Apply the concept of friction to simple engineering problems.
4. Calculate the displacement, velocity and acceleration of a moving particle.
5. Apply the work-energy, D ALEMBERTS principle to particles and connected systems.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3	2	1									3	1	
	2	3	2	1	1									2	1	
	3	3	3		2									3	2	
	4	3	3	2	2								1	3	2	
	5	3	3	2	2								1	3	2	

SYLLABUS

UNIT - I 12 Periods

Basic Concepts: Introduction to Engineering Mechanics – Scalar and Vector quantities – Forces – Characteristics of a force – Definitions and examples of various types of force systems – Definition of resultant – Composition and resolution of forces – Moment of a force – Principles of moments of force – Couples – characteristics of a couple – on Transformations of a couple – Resolution of a force into a force and couple. Resultants of Force Systems, possible resultants of different types of force systems.

Employability

UNIT - II 12 Periods

Equilibrium Analysis: Free body diagrams – Equations of equilibrium for a concurrent coplanar force system – Equilibrium of Bodies acted on by two or three forces – Equilibrium of bodies acted on by non-concurrent coplanar fo Employability uilibrium of bodies acted on by parallel, non-coplanar force system – Equilibrium of non-concurrent, non-coplanar non-parallel force system.

Analysis of trusses: Method of joints, Method of sections and tension coefficient method.

UNIT - III 12 Periods

Friction: Nature of friction – Laws of friction – Coefficient of friction – Angle of friction – Cone of friction – Problems involving frictional forces – Frictional forces on flexible bands and belts – Rolling friction – Thrust bearing.

Centroid and Centre of Gravity: Centre of gravity of parallel forces in a plane – Centre of gravity of parallel forces in space – centroids and centres of gravity of composite bodies – Theorems of Pappus.

Employability

UNIT - IV 12 Periods

Moments of Inertia: Definition – Parallel axis theorm for areas – Second moments of areas by integration – Radius of gyration of areas – Moments of inertia of composite areas.

Employability

Kinematics: Absolute Motion: Introduction – basic terminology of mechanics – Newton's Laws – Introduction to Kinematics of Absolute Motion – Rectilinear motion of a particle – Angular motion of a line.

UNIT - V 12 Periods

Kinetics: Introduction to kinetics – Force, mass and acceleration approach, Newton's laws of motion - D Alembert's principle – Work - Energy principle – Work done by a force – Work done by a varying force – Work done by a force system – Energy – Power – Work Energy equation for translation – Work done by a Spring – Principle of conservation of energy.

TEXT BOOKS

1. Engineering Mechanics by SS Bavikatti and Rajasekharappa, New Age International Pvt. Ltd.
2. Applied Mechanics by I.B. Prasad, Khanna Publishers.

REFERENCES

1. Engineering Mechanics by S. Timoshenko and D.H. Young, Pearson Prentice publication.
2. Engineering Mechanics by Basudeb Bhattacharyya, Oxford University Press.
3. Engineering Mechanics by F.L. Singer, HarperCollins Publishers.
4. Schaum's outline of engineering mechanics: Statics, by E. Nelson, Charles Best, W.G. McLean, Merle Potter.
5. Vector Mechanics & Statics by F.P. Beer and E.R. Jhonston Jr, McGraw Hill.
6. Engineering Mechanics: Statics by J.L. Meriam and L.G. Kraige. Wiley India Ltd.
7. Relevant NPTEL Courses.

SURVEYING - I

CIV 215 **Credits : 3**
Instruction : 3 Periods & 1 Tutorial / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Course Objectives:

The objective if the course is to prepare student

1. To measure the area by chaining.
2. To measure the area and distance between the points by compass.
3. To measure the elevation of points.

Course Outcomes:

At the end of the course the student will be able to

1. Calculate angles, distances and levels.
2. Identify data collection methods and prepare field notes.
3. Understand the working principles of survey instruments.
4. Estimate measurement errors and apply corrections.
5. Demonstrate an ability to compute volume of reservoirs using contours.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3			3			1	2	2	1	2	3	3	
	2	3	3			3			1	2	2		2	3	3	
	3	3	2	1		2				1	2	1	2	2	2	
	4	2	2			2				2	1	1	2	2	2	
	5	3	3	2		2				2	2	1	1	3	2	

SYLLABUS

UNIT - I 12 Periods

Introduction: Surveying – Definition; Objectives; Classification; Principles of surveying; Instruments for Surveying; Scale – Scales used for Maps and Plans; Preparation of Map and Plan.

Employability

Chain Survey: Classification of surveying-Principles of Surveying. Sources of errors-Linear measurements, direct measurement. Instrumentation for chaining – Errors due to incorrect chain-Chaining on un-even and sloping ground-Errors in chaining - Tape corrections – Problems: Base line measurement-Chain Triangulation – Check lines, Tie lines, Offsets. Basic problems in chaining obstacles in chaining-Problems - Conventional signs.

Employability

UNIT - II

Compass Survey: Introduction to compass survey Definitions of Bearing. True bearing, True meridian, Magnetic Meridian, Magnetic bearing – Arbitrary Meridian, R.B. & B.B of lines – Designation of bearings – W.C.B. & R.B. – Conversion of bearings from one system to the other Related problems – Calculation of angles for Employability culation of bearing for angles, Related problems – Theory of Magnetic compass (i.e. Prismatic compass) – Magnetic dip-Description of Prismatic compass. Temporary adjustments of compass-Magnetic Declination – Local attraction-Related Problems-Errors in compass survey.

Employability

UNIT - III 12 Periods

Traverse Surveying : Chain and compass traversing-Free or loose needle method – Fast needle method-Checks in closed and open traverse-Plotting methods of traverse Survey - Closing error-Balancing the traverse-Bowditch's method-Transist method, Gale's Travers table.

Employability

UNIT - IV 12 Periods

Levelling : Definitions of terms-Methods of leveling - Uses and adjustments of dumpy level-Temporary and permanent adjustments of dumpy level levelling staves - Differential leveling, Profile leveling - Cross sections - Reciprocal levelling. Precise leveling - Definition of BS, IS, FS, HI, TP-Booking and reduction of levels, H.I. methods-Rise and fall method-Checks-Related problems-Curvature and Refraction Related Problems-Correction-Reciprocal levelling-Related problems-L.S & C.S Levelling-Problems Errors in levelling.

Employability

UNIT - V 12 Periods

Contouring: Definitions- Contour Interval and horizontal equivalent - Characteristics of contours-methods of locating contours-Direct and indirect methods-Interpolation of contours-Contour gradient-Uses of contour maps.

Minor instruments : Uses and adjustments of the following minor instruments:
Plane Table and its accessories, Line Ranger, Optical Square, Abney level, Clinometer, Ceylon Ghattracer, Pantagraph, Sextant and Planimeter.

TEXT BOOKS

1. Surveying By Dr. K.R. Arora, Standard Book House.
2. Surveying Vol.1, 2 and 3 – By Punmia, Standard Book House.

REFERENCES

1. Surveying Vol. 1 and 2 – By S.K. Duggal. Tata Mc. Graw Hill Publishing Co.
2. A text book of Surveying by C.L. Kocchar, Dhanpatrai Publishing company.
3. A Text Book of Surveying and Levelling by R.Agor, Khanna Publishers
4. Surveying and Levelling Vol. I & Vol. II by T.P Kanetkar and S.V Kulkarni, Vidyarthi Griha Prakashan, 1988
5. Relevant NPTEL Courses.

STRENGTH OF MATERIALS

CIV 216 | **Credits : 3**
Instruction : 3 Periods & 1 Tutorial / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

1. To have basic knowledge of the stresses in springs, principal stresses, principal planes.
2. To have basic knowledge of the stresses in thin cylindrical, circular shafts and Springs.
3. To learn the concepts of stresses in compound sections and shear force and bending moment in different types of beams.

Course Outcomes:

At the end of this course student will be able to:

1. Understand and solve simple problems involving stresses and strain in two and three dimensions.
2. Analyses stress in two dimensions and understand the concepts of principal stresses and the use of Mohr circles to solve two dimensional stress problems.
3. Draw shear force and bending moment diagrams of simple beams and understand the relationships between loading intensity, shearing force and bending moment.
4. Compute the bending stresses in beams with one or two materials.
5. Apply sound analytical techniques and logical procedures in the solution of engineering problems.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3	2	3								2	3	3	
	2	3	3	2	2								1	3	2	
	3	3	3	2	2								1	3	2	
	4	3	3	2	2								1	3	2	
	5	3	3	2	3								2	3	3	

SYLLABUS

UNIT - I 12 Periods

Simple Stresses and Strains: Elasticity and plasticity – Types of stresses and strains – Hooke's law– stress – strain diagram for mild steel and HYSD-bars Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic constants and the relationship between them – Bars of varying section – composite bars – Temperature stresses.

Skill Development

UNIT - II 12 Periods

Shear Force and Bending Moment in beams: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads, moment and combination of these loads – Point of contra flexure – Relation between S.F, B.M and rate of loading at a section of a beam.

Skill Development

UNIT - III 12 Periods

Bending Stresses: Theory of simple bending – Assumptions – Derivation of bending equations, Neutral axis – Determination of bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections.
Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

Skill Development

UNIT - IV 12 Periods

Principal Stresses and Planes: Introduction – Principal planes and Principal Stresses – Method of determining stresses on an inclined section of a member subjected to direct stresses in one plane – member subjected to direct stresses in two mutually perpendicular directions – member subjected to simple shear stress - member subjected to direct stresses in two perpendicular directions accompanied by a state of simple shear – Mohr's circle of stresses

Introduction to theories of failure: (i) Principal Stress theory, (ii) Principal Strain theory, (iii) Maximum Shear Stress theory and (iv) Maximum strain energy theory.

Skill Development

UNIT - V 12 Periods

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsional Rigidity equation – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shaft

Skill Development

Springs: Introduction – Types of springs – deflection of closed and open coiled helical springs under axial load and axial twist.
Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.

Skill Development

TEXT BOOKS

1. Ramamrutham, Strength of materials, Dhanpat Rai & Sons.
2. R K Bansal, Strength of materials, Laxmi Publications Pvt. Ltd.

REFERENCES

1. Timoshenko and Young, Elements of strength of materials Affiliated East-West Press Pvt. Ltd.
2. Mechanics of Materials, Beer and Jhonston, Tata McGraw Hill.
3. P.N. Singer and P.K. Jha, Elementary mechanics of solids, New Age International Pvt.Ltd.
4. Mechanics of Solids by Egor P. Popov, Pearson Education.
5. Relevant NPTEL Courses.

SURVEY FIELD WORK - I

CIV 217 | **Credits : 2**
Instruction : 3 Practical / week | Sessional Marks : 50
End Exam : 3 Hours | End Exam Marks : 50

Course Objectives:

1. To know how to conduct the experiments by using different survey instruments.
2. To improve practical knowledge.

Course Outcomes:

At the end of this course student will be able to:

1. Improve ability to function as a member of a survey party in completing the assigned field work.
2. Conduct survey and collect field data
3. Prepare field notes from survey data
4. Learn the measurement of elevation difference between two points using Level instruments.
5. Interpret survey data and compute areas and volumes.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3	2		2				2	2		2	3	2	
	2	3	3	2	2	2				2	2		1	3	2	
	3	3	2	1	2	2				2	1			2	2	
	4	3	2	1	1	2				1	2			2	2	
	5	3	2			2				1	2		1	3	2	

LIST OF EXPERIMENTS:

1. Introduction & list of equipments
2. Chain surveying - Aligning, Ranging and Chaining
3. To determine the area of the given plot using chain, tape & cross–staff.
4. To find the distance between inaccessible points using Compass Surveying.
5. Traversing using prismatic compass.
6. Measurement of elevation difference between two points using and Leveling Instrument.
7. Elevation difference between two points by Reciprocal levelling method.
8. Differential levelling, reduction of levels by rise and fall method.
9. Differential levelling, reduction of levels by height of collimation method.
10. Longitudinal and Cross Sectioning.
11. Contouring of a small area by method of Blocks.

Employability

REFERENCES

1. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain., Surveying I & II, Laxmi Publications, 2005.
2. Relevant NPTEL Courses.

STRENGTH OF MATERIALS LABORATORY

CIV 218 | **Credits : 2**
Instruction : 3 Practical / week | Sessional Marks : 50
End Exam : 3 Hours | End Exam Marks : 50

Course Objectives:

The student shall have the knowledge of

1. The stress – strain characteristics of mild steel bar.
2. The methods of determining modulus of elasticity, modulus of rigidity of spring and shaft materials.
3. The concepts of hardness, compressive strength, shear strength, impact strength and tensile strength of different materials.

Course Outcomes:

At the end of this course student will be able to

1. Determine the engineering and mechanical properties of materials.
2. To interpret the test results

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	1	1	1	2	2				2	1			1	2	
	2	1	1	1	2	2				2	1			1	2	

LIST OF EXPERIMENTS:

1. Tension test on Mild Steel / HYSD bars.
2. Compression test on wood (parallel to grains and perpendicular to grains)
3. Test on close coiled helical spring for the determination of rigidity modulus and spring constant
4. Hardness tests - Brinell's & Rockwell's.
5. Impact tests – Charpy and Izod
6. Torsion test.
7. Bending test.: Load deflection test for the determination of young's modulus on simply supported and cantilever beam for wood and steel.

Employability

REFERENCES

1. P.N. Singer and P.K. Jha, Elementary mechanics of solids, New Age International Pvt.Ltd.
2. Relevant NPTEL Courses.

CONCRETE TECHNOLOGY

CIV 221 | **Credits : 3**
Instruction : 3 Periods & 1 Tutorial / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

1. Learn about the manufacturing of cements and hydration process
2. Use different types of cement and admixtures as per their properties for different field applications.
3. Student shall learn about the various ingredients of concrete, admixtures, workability and strength of hardened concrete

Course Outcomes:

At the end of course student will be able to:

1. Understand the composition, manufacturing process and properties of cement.
2. Understand the classification, characteristics and properties of aggregate.
3. Acquire the skill of testing, supervision of concrete work & interpretation of tests results.
4. Understand the behaviour of hardened concrete.
5. Understand the need for special concretes.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	3	2	3	3		2					1	3	3	2
	2	2	2	2	2	3								2	3	
	3		2	2	3	2		3					1	2	3	3
	4		3	2		2		3						3	2	3
	5		2	2	3	2		3					1	2	3	3

SYLLABUS

UNIT - I 12 Periods

Cement: Composition of ordinary Portland cement- oxide composition and compound composition- their functions in cement. Manufacture of ordinary Portland cement by wet process and dry process. Types of cement - OPC & blended (only fly ash & slag) and their uses. Tests on cement – field tests – laboratory test (Test procedure not required)

Employability

UNIT - II 12 Periods

Aggreagate: Classification of aggregate based on origin , shape , size, unit weight: Manufactured sand (M – Sand) – characteristics of aggregates – strength, particle shape and texture ,specific gravity ,bulk density ,voids, porosity and absorption of aggregates – moisture content of aggregate – bulking of fine aggregate. Tests on aggregates.

Employability

(Test procedure not required)

UNIT - III 12 Periods

Fresh Concrete: Manufacture of concrete – Batching, Mixing, Transportation, Placing, Vibrating, Finishing, Curing – Workability – Factors affecting workability – segregation and bleeding – Tests available for measurement of workability (Test procedure not required)
Admixtures: Admixtures – functions of admixtures – General purpose admixtures such as Retarding admixture, Accelerating admixtures, Air Entraining admixtures, Water reducing admixture

Employability

UNIT - IV 12 Periods

Hardend Concrete: Strength of concrete – water-cement ratio – gel-space ratio – gain of strength with age – effect of maximum size of aggregate on strength – compressive strength – flexural strength – tensile strength of concrete – bond strength – factors affecting the strength of concrete. Introduction to creep and shrinkage of concrete – Tests on hardened concrete (Test procedure not required)

UNIT - V 12 Periods

Special Concrete: Introduction to special concrete – lightweight concrete – no fines concrete – fibre reinforced concrete – self compacting concrete
Concrete Mix Design: Concrete mix design – BIS Method of mix design

Employability

TEXT BOOKS

1. Concrete Technology – M. S. Shetty – S Chand Co., Publishers – 2006.
2. Properties of Concrete – AM Nevelli – 5th Ed, Prentice Hall Publishers, 2012.

REFERENCES

1. Concrete Technology – M. L. Gambhir – Tata Mc Graw Hill Publishers – 2012.
2. Concrete Technology 3 Edition, Gupta B L, & Amit Gupta, Standard Publishers and Distributors
3. Concrete Technology, A.R.Santha Kumar, Oxford University Press
4. Relevant NPTEL Courses.

ENVIRONMENTAL ENGINEERING - I

CIV 222 **Credits : 3**
Instruction : 3 Periods & 1 Tutorial / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Course Objectives:

1. The principal objective of the course is to develop the technical knowledge for better understanding the concepts of water supply and its characteristics and enabling them to use these technical skills in solving the problems in industries.
2. To impart the knowledge in planning, design, construction, operation and maintenance aspects of water supply systems.
3. To provide theoretical and practical exposure in the field of water treatment and supply.
4. To increase the management skills with regard to collection, treatment and distribution of sustainable water.

Course Outcomes:

By the end of the course the student will be able to

1. Understand the sources of water, quality of water, types of water borne diseases.
2. Learn to estimate demand for water supply, and can apply the physical principles of flow in water distribution networks and pumping stations.
3. Design water treatment systems and operations and working of different units.
4. Design elements of public water systems, pumping and transportation of water, distribution systems, and components of water supply network in a town/city, functioning of water/sewer pipe appurtenances.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	3	3	3	2	2	3				3	3	3	2
	2	3	3	3	3	3	2	2	3				3	3	3	2
	3	3	3	3	3	3	2	2	2				3	3	3	2
	4	3	3	3	3	3	2	2	3				3	3	3	2

SYLLABUS

UNIT - I 10 Periods

Introduction: Introduction: Importance and Necessity of Protected Water Supply systems, Objectives of Protected water supply system, Flow chart of public water supply system, Role of Environmental Engineer, Agency activities.

Water Demand and Quantity studies : Estimation of water demand for a town or city, Types of water demands, Per capita Demand, Factors affecting the Per Capita Demand, Variations in the Demand, Design Period, Factors affecting the Design period, Population Forecasting Studies.

UNIT - II 10 Periods

Quality: Characteristics of water – Physical, Chemical and Biological. Analysis of Water – Physical, Chemical and Biological. Impurities in water, Water borne diseases. Drinking water quality standards.

Skill Development

UNIT - III 10 Periods

Sources of Water Supply: Surface sources of water: Lakes, Rivers, Impounding Reservoirs, Capacity of storage reservoirs, Mass curve analysis. Groundwater sources of water: Types of water bearing formations, springs, Wells and Infiltration galleries, Yields from wells and infiltration galleries.

Collection and Conveyance: Factors governing the selection of the intake structure, Types of Intakes. Conveyance of Water: Gravity and Pressure conduits, Types of Pipes, Pipe Materials, Pipe joints, Design aspects of pipe lines, Laying of pipe lines.

UNIT - IV 12 Periods

Treatment of Water: Layout and general outline of water treatment units –Treatment methods (Theory and Design) - Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration, Chlorination and other Disinfection methods, Softening of Water, Defluoridation, Removal of Odours.

Skill Development

UNIT - V 12 Periods

Pumping: Necessity of pumping in water supply - classification and brief description of types of pumps - selection of pump - calculation of head, horsepower - economical diameter of pumping main.
Distribution System: Distribution of Water: Methods of Distribution system, Components of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks, Water connection to the houses.
Building Plumbing: Water Supply system – Fixing the pipes in building, high rise buildings – Maintenance of building pipe line – Water Meters.

TEXT BOOKS

1. Birdie G S and Birdie J S, "Water Supply and Sanitary Engineering", Dhanpat Rai and Sons, Delhi, Fifth Edition, 1997
2. Garg, S.K, "Environmental Engineering Vol. I ", Khanna Publishers, New Delhi, 1994.

REFERENCES

1. Modi, P.N, "Environmental Engineering Vol. I", Standard Book House, New Delhi, 2001.
2. Punmia B.C, "Environmental Engineering Vol. I", Lakshmi Publications (P) Ltd., New Delhi, 2002.
3. Deswal S and Deswal A, "A basic course in Environmental studies", Dhanpat Rai & Co, First edition, Delhi, 2004

4. Hand book on Water Supply and Drainage, SP35, B.I.S., New Delhi, 1987.
5. National Building Code of India, SP 7 (1) – 1983, Bureau of Indian Standards, First Reprint, May 1992.
6. Relevant NPTEL Courses.

FLUID MECHANICS - I

CIV 223 | **Credits : 4**
Instruction : 4 Periods & 1 Tutorial / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

1. To develop an insight into engineering problems related to fluids.
2. Student is expected to learn about the pressure at a point, forces on fluid element to solve complex problems in engineering.
3. Student shall be able to know different types of fluid flows and apply the principles of conservations of mass, momentum and energy.

Course Outcomes:

By the end of the course the student will be able to

1. Determine the physical properties of fluids and different types of forces acting on a fluid element extended to forces on various gates.
2. Determine the forces that are acting on immersed bodies in static fluids through application of buoyancy and floatation.
3. Determine different types of fluid flows to find out the local and convective accelerations in 1D, 2D flows fields and derive the Laplace equation.
4. Apply conservation principles of mass momentum and energy on fluids through system and control volume approaches.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	1										1	1		
	2	1	1										1	1		
	3	2	3		2								2	3	2	
	4	2	3	1	2								3	2	2	

SYLLABUS

UNIT - I 14 Periods

Basic Fluid Properties: Definition of Fluid, basic properties of fluid, Viscosity - Newton's Law of Viscosity, Capillarity and Surface Tension.
Fluid Pressure: Fluid Pressure at a point, Pascal's law, Variation of pressure with elevation, Hydrostatic law, Absolute, Gauge and Vaccum Pressures. Pressure measurement – Piezometers, Manometers and Pressure Gauges. Centre of Pressure, Forces on submerged surfaces, crest gates and lock gates.

Employability

UNIT - II 14 Periods

Buyoancy and Floatation: Archimedes Principle- Buoyancy & Floatation - Stability of Floating Bodies- Centre of Buoyancy - Metacentric Height and its Determination.

Fluid Kinematics: Types of fluid flow, Velocity, Rate of flow, Continuity Equation, Streamline, Path line, Streak line, Local, Convective and Total Acceleration; One & Two Dimensional Flows. Stream Function, Velocity Potential- Rotational & Irrotational Flows, Laplace Equation, Flow net.

Employability

UNIT - III 14 Periods

Fluid Dynamics: Energy possessed by fluid in motion, Euler's equation of motion - Bernoulli's equation. Energy correction factor.

Flow through orifices and mouth pieces: Types of orifices and mouth pieces, coefficient of contraction, velocity and discharge.

Flow through notches and weirs: Types of notches and weirs, Measurement of discharge.

Employability

UNIT - IV 14 Periods

Impulse momentum equation – Momentum correction factor, Forces on pipe bends and reducers. Angular Momentum – Torque and work done; Sprinkler Problems.

Laminar Flow: Relation between Shear and Pressure Gradients in Laminar Flow; Reynold's experiment; Critical velocity; Steady laminar flow through a circular pipe – Hagen Poiseuille's Law.

Employability

UNIT - V 14 Periods

Flow through pipes: Flow measurement through pipes – Venturimeter, orificemeter, nozzle meter. Loss of head, head loss due to friction – Darcy –Weisbach equation, minor losses, Total Energy Line, Hydraulic Gradient Line. Pipes in Series, pipes in parallel. Problems on Two reservoir and three reservoir flows. Water hammer, surge tanks.

Employability

TEXT BOOKS

1. Fluid Mechanics and Hydraulic Machinery by P.N. Modi & S.M. Seth, Standard Book House.
2. Fluid Mechanics by A.K. Jain, Khanna Publishers

REFERENCES

1. Hydraulics Fluid Mechanics and Fluid Machines, S.Ramamrutham, Dhanpat Rai Publishing Co.
2. Engineering Fluid Mechanics by K.L. Kumar, S. Chand & Co
3. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publications.
4. F M White, Fluid Mechanics, Tata McGraw Hill Publication 2011.
5. Relevant NPTEL Courses.

SURVEYING - II

CIV 224 | **Credits : 3**
Instruction : 3 Periods & 1 Tutorial / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

1. To measure the height and distance by theodolite.
2. To measure the angles and distances by using tacheometric and trigonometric methods.
3. To measure distances and angles by total station.

Course Outcomes:

By the end of the course the student will be able to

1. Learn to determine horizontal and vertical angles between points.
2. To impart experimental skills to determine heights and distances of inaccessible objects.
3. Apply surveying skills in aligning highways and railway curves.
4. Demonstrate the ability to solve surveying problems.
5. Learn basics in GIS and GPS.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3			3							1	3	3	
	2	3	3	1		3							1	3	3	
	3	3	3	2	1	3							1	3	2	
	4	3	3	2	1	1							1	3	1	
	5	3	3	1		3							2	3	3	

SYLLABUS

UNIT - I 10 Periods

Theodolite Survey: Theodolite Component Parts, Classification, – Temporary Adjustments, Measurement of horizontal angles – Method of repitition, Method of reiterition – Uses of theodolities – Errors in theodolite or Permanent adjustments of a theodolite – Identification – Rectifying the errors.

Employability

UNIT - II 12 Periods

Theodolite Traversing: Open and closed traverse – Closing errors, Balancing the error – Bowditch method – Transit method, Omitted measurements – Gales traverse table – Axis Signal Correction.
Trigonometric leveling: Elevation of the tower – Base of the object accessible and inaccessible – Reduced level of the elevated points – Instrument axis at different levels.
Triangulation: Principle of triangulation - Purpose and classification of triangulation surveys – Layout of triangulation.

Employability

Employability

UNIT - III 10 Periods

Tacheometry : Instruments - Principle of techeometry – Methods of Tacheometry - Stadia methods – Fixed hair method – Movable hair method – Tangential method – Subtanse bar – Beaman's stadia, Arc – Reduction diagrams or Triangulation – Classification - intervisibility of station – Signals and towers-base line measurements.

Employability

Employability

UNIT - IV 12 Periods

Curves: Types of Curves - Simple curves – Elements of simple curves – Methods of setting simple curves – Rankines method – Two theodolite method – Obstacles in curve setting – Compound curves – Elements of compound curves or Reverse curves – Elements of reverse curve – Determination of various elements – Transition curves – Ideal shape – Spiral transition curves - length of transition curve - Setting out methods.

Employability

UNIT - V 10 Periods

Modern Surveying Instruments: Electronic Theodolite, Introduction to geodetic surveying, EDM Instruments, Total station and global positioning system- Introduction to Geographic Information System (GIS)

Employability

TEXT BOOKS

1. Surveying Vol.1,2 and 3 – By Punmia, Standard Book House.
2. Surveying By Dr. K.R. Arora, Standard Book House.

REFERENCES

1. Surveying Vol. 1and 2 – By S.K. Duggal. Tata Mc. Graw Hill Publishing Co.
2. A text book of Surveying by C.L. Kochhar, Dhanpatrai Publishing Company.
3. A Text Book of Surveying and Levelling by R.Agor, Khanna Publishers
4. Surveying and Levelling Vol. I & Vol. II by T.P Kanetkar and S.V Kulkarni, Vidyarthi Griha Prakashan, 1988
5. Principles of GIS for land resource assessment by P.A. Burrough –Clerendon Press, Oxford.
6. Relevant NPTEL Courses.

STRUCTURAL ANALYSIS - I

CIV 225 | **Credits : 4**

Instruction : 4 Periods & 1 Tutorial / week — Sessional Marks : 40

End Exam : 3 Hours — End Exam Marks : 60

Course Objectives:

1. Apply suitable methods for calculating deflections in statically determinate beams and trusses.
2. Apply suitable methods for analyzing statically indeterminate beams.
3. Analyze beams under moving loads.

Course Outcomes:

At the end of the course the student will be able to

1. Calculate deflections in statically determinate beams and trusses.
2. Analyze columns and struts under axial loading.
3. Calculate strain energy due to different types of forces.
4. Analyze statically indeterminate beams.
5. Analyze fixed and continuous beams.
6. Understand how shear force and bending moment vary with application of moving loads.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	**1**	3	3	2	3								2	3	3	
	2	3	3	2	2								1	3	2	
	3	3	3	2	2								1	3	2	
	4	3	3	2	2								1	3	2	
	5	3	3	2	2								1	3	2	
	6	3	3	2	3								2	3	3	

SYLLABUS

UNIT - I — 13 Periods

Combined bending and direct stresses: Resultant stress when a column of rectangular section is subjected to eccentric load along one axis and along both the axes- kern of a section.

Columns and Struts: Euler's theory – end conditions. Rankine – Gordon formula – other empirical formulae – Eccentrically loaded columns – Perry's formula, Secant formula.

Skill Development

UNIT - II — 15 Periods

Deflections of statically determinate beams: (a) Double integration method (b) Macaulay's method (c) Moment area method, (d) Conjugate beam method.

Skill Development

4 Periods

UNIT - III

Strain energy: Expression for strain energy stored in body due to
(i) Axial load, (ii) Shear force, (iii) Bending Moment and (iv)Torque

Deflections of Statically Determinate Beams: (a)Unit load method (b) Castigliano's theorm – 1.

Deflections of Statically Determinate Trusses: (a) Unit load method (b) Castigliano's theorm – 1.

Skill Development

UNIT - IV 14 Periods

Analysis of Statically Indeterminate Beams: (a) fixed beams, (b) three span continuous beams using (i) Theorem of three moments, (ii) Slope deflection method and (iii) Moment distribution method.

Skill Development

UNIT - V 14 Periods

Moving loads and Influence lines: Maximum Shear force and Bending moment diagrams for different types of loads. Maximum Bending moment at a section under a wheel load and absolute maximum Bending moment in the case of several wheel loads. Equivalent uniformly distributed live load for Shear force and Ben

Skill Development

TEXT BOOKS

1. Theory of structures – Ramamrutham. Dhanpat rai Publishing company.
2. Theory of Structures by BC Punmia and Arun Kumar Jain and AK Jain, Laxmi Publications

REFERENCES

1. Theory of structures by S.P. Timoshenko and D.H. Young, McGraw Hill International Editions.
2. Basic Structural Analysis by CS Reddy, Tata McGraw Hill Education.
3. Analysis and Design of structures – Vazirani and Ratwani, vol 1, Khanna publishers.
4. Structural analysis by Thandavamoorthy, Oxford University Press.
5. Structural analysis by S.S.Bhavakatti. Vol I, Vikas Publishing House Pvt Ltd.
6. Relevant NPTEL Courses.

BUILDING PLANNING AND DRAWING

CIV 226 | **Credits : 3**

Instruction : 1 Lecture & 3 Practical / week | Sessional Marks : 40

End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

1. To understand the principles of planning and bylaws.
2. To draw plan, elevation and section of load bearing and framed structures.
3. To prepare detailed drawings for doors, windows, etc.

Course Outcomes:

1. Understand various types of buildings and housing concept.
2. Apply the concepts of climatology and orientation of both residential and commercial buildings.
3. Apply the principles of planning and bylaws used for building planning.
4. Recommend appropriate planning for 2 Bed room and 3 Bed room houses.
5. Draw plan, elevation and section for various structures.
6. Design individual rooms with attention to functional and furniture requirements.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3		3		3	3	3	3		3	3	3	3	3	2
	2	1		1		1	1	3	3		1	1	3	1	1	3
	3	1		3		1	3	3	3		3	3	3	2	2	3
	4	3		3		3	2	3	3		3	3	3	3	3	3
	5	3		3		1	3	3	2		3	3	3	3	2	3
	6	1		3		1	3	3	3		3	3	3	2	2	3

SYLLABUS

UNIT - I 12 Periods

Climatology: Elements of climate: Sun, Wind, Relative Humidity, and Temperature. Mahoney Tables, Comfort conditions for house. Various types of Macroclimatic zones, Design of Houses and layouts with reference to climatic zones. Solar charts. Wind Roses, Ventilation.

Principles of Planning, Orientation of Buildings.

UNIT - II 12 Periods

Design of Individual rooms with particulars attention to functional and furniture requirements (for internal evaluation only). Residential Buildings: Different types of Residential Buildings, Selection of site for residential buildings. Guidelines for planning and drawing of residential building. General Building regulations and Bye laws for Residential Buildings.

Skill Development

UNIT - III 36 Periods

Drawing: At least ten sheets shall be drawn during the semester manually using mini-drafter/setsquares (along with AUTOCAD), (a) Conventional signs of materials, various equipment used in a Residential Building (copying exercise). Plan, Sectional Elevation, Front Elevation and site plan for the following.

(a) A Small House (One Room and Verandah) (Copying exercise), (b). Three bed roomed House in HOT and ARID zone, Hot and humid zone & Cold zone(copying exercise), (c) Houses with given Functional requirements and climatic data. Emphasis may be given to Hot and Humid (d) Duplex Type Houses

Skill Development

Skill Development

Note:

1. AUTOCAD Drawings for internal assessment only.
2. The question paper consists of Part-A and Part-B. Part-A consists of 4 questions, 2 questions for each of Unit – I & II and Part-B consists of a compulsory question for 36marks

TEXT BOOKS

1. Building Planning and Drawing by Dr.N. Kumara Swamy and A.Kameswara Rao, Charotar Publishing House.
2. Building Planning Drawing and Scheduling by Gurucharansingh and Jagadish Singh, Standard Publishers Distributors.

REFERENCES

1. Building Drawing with an integrated approach to Built environment by M.G.Shah, C.M.Kale and S.Y.Patki, McGraw-Hill Publishing Company Limited, New Delhi.
2. Civil Engineering Drawing Series ‘B’ by R.Trimurty, M/S Premier Publishing House.
3. Relevant NPTEL Courses.

CONCRETE TECHNOLOGY LAB

CIV 227 **Credits : 2**
Instruction : 3 Practical / week Sessional Marks : 50
End Exam : 3 Hours End Exam Marks : 50

Course Objectives:

1. To apply the basic knowledge of civil engineering in selecting appropriate cement, fine and coarse aggregates in making concrete.
2. To be able to make concrete of required strength.

Course Outcomes:

At the end of this course student will be able to

1. Determine the properties of concrete and its ingredients
2. Check the suitability of various ingredients of concrete in constructions

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	1	2	3	1				1	1		2	2	2	
	2	2	1	2	3	2				1	2		2	2	3	

LIST OF EXPERIMENTS:

1. Specific gravity and unit weight of cement
2. Specific gravity and unit weight of coarse aggregates.
3. Specific gravity and unit weight of fine aggregates.
4. Fineness of cement,
5. Consistency of cement
6. Initial and final setting time of cement.
7. Compressive strength of cement (for different grades of cement).
8. Bulking of sand.
9. Sieve analysis of coarse and fine aggregates
10. Workability tests on fresh concrete by using: Slump cone, Compaction factor apparatus, Flow table, Vee-Bee Consistometer.
11. Compressive Strength of concrete
12. Split tensile strength of concrete
13. Modulus of rupture of concrete

EMPLOYABILITY

REFERENCES

1. Properties of Concrete – AM Nevelli – 5th Ed, Prentice Hall Publishers, 2012.
2. Concrete Technology – M. S. Shetty – S Chand Co., Publishers – 2006.
3. Relevant NPTEL Courses.

FLUID MECHANICS LAB - I

CIV 228 | **Credits : 2**
Instruction : 3 Practical / week | Sessional Marks : 50
End Exam : 3 Hours | End Exam Marks : 50

Course Objectives:

The objective of the course is to enable the student to calibrate different types of flow measuring devices to measure flow in tanks, pipes and open channels.

Course Outcomes:

At the end of this course student will be able to

1. Calibrate various flow measuring devices
2. Apply Bernoulli's Principle for pipes and open flows

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	1	1	2					3	1		1	1	2	
	2	2		1	3					2			1	2	3	

LIST OF EXPERIMENTS:

1) Calibration of a small orifice by constant head method and falling head method
2) Time required for emptying the tank through the small orifice.
3) Calibration of a cylindrical mouth piece by constant head method and falling head method.
4) Time required for emptying the tank through the mouth piece.
5) Calibration of Venturi meter
6) Calibration of Orifice meter.
7) Calibration of Flow nozzle meter.
8) Calibration of a triangular V Notch
9) Calibration of a rectangular notch.
10) Calibration of a trapezoidal notch.
11) Experimental verification of laminar, transition and turbulent flows using Reynolds apparatus.
12) Verification of Bernoulli's Equation.

Employability

REFERENCES

1. Fluid Mechanics and Hydraulic Machinery by P.N. Modi & S.M. Seth, Standard Book House.
2. Relevant NPTEL Courses.

SURVEYING FIELD WORK - II

CIV 229 | **Credits : 2**
Instruction : 3 Practical / week | Sessional Marks : 50
End Exam : 3 Hours | End Exam Marks : 50

Course Objectives:

1. To know how to conduct the experiments by using different survey instruments.
2. To improve practical knowledge.

Course Outcomes:

At the end of this course student will be able to

1. Demonstrate an ability to conduct surveying for any infrastructure project.
2. Analyses data and report results.
3. Work in teams doing field work and computer analysis.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	1		2				2	2			2	2	
	2	3	3	2	2	1				2	2			3	2	
	3	3	2	1	2	2				1	1			2	2	

LIST OF EXPERIMENTS:

1. To determine horizontal angle by repetition method
2. To determine horizontal angle by reiteration method
3. To determine the vertical angles.
4. To determine Reduced level of different points.
5. To determine height of the object when base is accessible and base inaccessible.
6. To determine the Tacheometric Constants
7. To determine gradient between two points

   Employability
8. Setting of simple curve using tape, Rankine's Method and Two theodolite Method
9. Study of Instrument – Determination of Distances, Directions and Elevations (Total Station)
10. Determination of Boundaries of a Field and computation of area using Total Station.
11. Determination of Heights of objects using Total Station.

REFERENCES

1. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain., Surveying I & II, Laxmi Publications, 2005.
2. Relevant NPTEL Courses.

TECHNICAL SEMINAR

CIV 2210 **Credits : -**
Instruction : 2 Practical / week Sessional Marks : -
End Exam : - End Exam Marks : -

Course Objectives:

The objective of this course is

1. To enhance the communication skills of the students through participation and giving seminars.
2. To develop an overview of civil engineering and its applications in the students.
3. To promote teamwork and lifelong learning among the students.

Course Outcomes:

At the end of the course the students will be able to

1. Make presentation on a given topic related to civil engineering.
2. Improve the communication skills.
3. Broaden their knowledge about civil Engineering and its practical applications.
4. Update their knowledge on the latest developments in civil engineering.
5. Understand the environmental, safety, economical and sustainability aspects of any civil engineering structure.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2			2		2	2		3	3		2	2	3	2
	2									3	3		2		3	2
	3	2	2	2	2	2	2	2		3				2	2	2
	4		2	2	2	2	2	2		3				2	2	2
	5			2			2	2		3				2		3

OUTLINE OF SYLLABUS

Students have to prepare a Report on a cas Skill Development ical application in civil engineering and make a presentation in teams of maximum 2 students. Duration of each seminar shall be 20 minutes per team including discussion. Evaluation to be done by a Panel of Examiners nominated by HoD with at least one faculty member of specialization related to the seminar topic.

REFERENCES

1. National & International Journals / Standard Magazines / Reports / Case Studies in civil engineering.
2. NPTEL courses in civil engineering.
3. World Wide Web resources on state of the art in civil engineering.

OPEN ELECTIVES

(For III B.Tech. I Sem All except Civil Engineering students)

BASIC CIVIL ENGINEERING

CIV 311(A)	**Credits : 3**
Instruction : 3 Lectures & 1 Tutorial / week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisite:

Nil

Course objectives:

The objective of this course is to

1. Know the various materials and components in building construction
2. Have knowledge on survey and highways engineering, irrigation and water supply engineering and soil mechanics.

Course outcomes:

At the end of this course the student will be able to

1. Student will able to identify various materials, components in building construction.
2. Student will be familiar in various disciplines in civil engineering.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	1	-	-	-	1	1	-	1	1	-	-	1	-	2
	2	3	1	-	-	-	2	2	-	1	1	-	-	1	-	2

SYLLABUS

UNIT – I 12 Periods

Skill Development

Construction materials

Stones -Characteristics of good building stones-common building stones and their uses-Bricks-Characteristics of good bricks-classification of bricks and their uses-Timber-Classification of Timber and their uses-Cement-Types of cement and their uses

UNIT – II 12 Periods

Skill Development

Components of building

Components of sub structure and their functions-Components of super structure and their functions -Types of forces – compression, tension, shear – Stress – Strain-Concrete-Ingredients of concrete and its importance in construction -Steel- Types of steel and its importance in construction

UNIT – III 12 Periods

Skill Development

Survey and Highway Engineering

Definition and classification of surveying – linear and angular measurements - levelling Modes of transportation – Classification of highways - Classification of pavements - Super elevation.

UNIT – IV 12 Periods

Skill Development

Irrigation and Water supply

Definition and classification of irrigation – Irrigation structures – dams, weirs, cross drainage works, canal drops-Quality of water-Treatment methods

UNIT – V 12 Periods

Skill Development

Geotechnical Engineering

Origin of soil – types of soil – bearing capacity of soil – Types of foundation – shallow and deep

REFERENCES

1. B C Punmia, Ashok K Jain, Arun K Jain, (1st Edition, 2003), "Basic Civil Engineering", Laxmi Publications (P) Ltd.

2. G K Hiraskar, (1st Edition, 2004), "Basic Civil Engineering", Dhanpat Rai Publication.

Note: As the subject is an Open elective taken by non-civil engineering students, the student is expected to gain only elementary knowledge of the subject.

BUILDING PLANNING AND CONSTRUCTION

(For III B.Tech. I Sem All except Civil Engineering students)

CIV 311(B) — **Credits : 3**
Instruction : 3 Lectures & 1 Tutorial / week — Sessional Marks : 40
End Exam : 3 Hours — End Exam Marks : 60

Prerequisite:

Nil

Course Objective:

1. Learn about building byelaws laid by planning authorities.
2. Learn about the principles and methods to be followed in constructing various components of a building.
3. Understand about masonry types in brick and stone construction

Course Outcomes:

At the end of the course the student will be able to

1. Know the various building Bye-Laws laid by town planning authorities and local regulatory bodies for planning various buildings
2. Learn about masonry types in brick and stone construction
3. Understand about various building components.
4. Know about damp prevention and fire protection methods.
5. Understand about various types of roofs.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	1	-	-	3	3	2	1	1	-	2	3	2	3
	2	3	2	2	-	-	-	2	1	-	1	2	2	2	1	2
	3	3	3	1	2	-	2	2	1	2	2	2	2	3	2	2
	4	3	-	2	1	2	2	2	-	2	1	2	3	3	2	3
	5	3	1	2	1	-	1	1	-	1	1	2	2	3	2	2

SYLLABUS

UNIT – I — 12 Periods

Residential Buildings : Different types of Residential Buildings Selection of Site for Residential Building, Components of building, bye-laws and regulations, Orientation of Buildings

EMPLOYABILITY

UNIT – II — 12 Periods

Masonry: Definitions of terms used in masonry, Materials used, Stone masonry, Brick masonry, Different bonds used for brick masonry, Composite masonry.

UNIT – III — 12 Periods

Floors and Roofs: Components of a floor, materials used for floor construction, Different types of flooring, Ground floor and upper floors, Types of roofs, Basic roofing elements and Roof coverings.

Employability

UNIT – IV 12 Periods

Doors and Windows: Location of roofs and windows, Definition of technical terms, Size of doors and windows, Door frames, Types of doors and windows, Ventilators, Fixtures and fastenings.

Employability

UNIT – V 12 Periods

Damp proofing: Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards, Fire resisting properties of common building materials.

REFERENCES

1. N. KumaraSwamy & A. Kameswara Rao, (1998),” Building planning and Drawing, Charotar Publishers, (6th Edition).
2. S.K. Duggal, (2010), “Building Materials” New Age International Publishers, (4th Edition).
3. Dr. B.C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, (2008), “Building Construction”, Laxmi Publications, (10th Edition)
4. D.N. Ghose , (1989), “Materials of construction”, Tata-McGraw-Hill Publishing Company Limited.
5. Sushil Kumar Sushil Kumar, (2003), “Engineering Materials”, Metropolitan Book Co., Private Ltd., New Delhi.

Note: As the subject is an Open elective taken by non-civil engineering students, the student is expected to gain only elementary knowledge of the subject.

ENVIRONMENTAL ENGINEERING – II

CIV312 | **Credits: 3**
Instruction: 3 Lecture & 1 Tutorial / week | Sessional marks: 40
End Exam: 3 hours | End Exam Marks: 60

Prerequisites:

Engineering Chemistry; Environmental Engineering – I.

Course Objectives:

The objective of this course is to:

1. Outline planning and the design of wastewater collection, conveyance and treatment systems for a community/town/city.
2. Provide knowledge of characterisation of wastewater generated in a community.
3. Summarize the appurtenance in sewerage systems and their necessity and Impart understanding and need of treatment of sewage.
4. Teach planning, and design of septic tank and Imhoff tank and the disposal methods of the effluent from these low cost treatment systems and realise the importance of regulations in the disposal of effluents in rivers.

Course Outcomes:
At the end of this course, the students will be able to:

1. Plan and design the sewerage systems
2. Select the appropriate appurtenances in the sewerage systems
3. Selection of suitable treatment flow for sewage treatment
4. Identify the critical point of pollution in a river for a specific amount of pollutant disposal into the river

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	3	3	3	3	3	3				1	3	3	3
	2	3	2	2	2	3								3	3	3
	3		2	2	3	2	3	3					1	2	3	3
	4		3	2		2	3	3	2					3	2	3

SYLLABUS

UNIT – I 12Periods

Introduction to sanitation: Systems of sanitation – relative merits & demerits – collection and conveyance of waste water – sewerage – classification of sewerage systems- Estimation of sewage flow and storm water drainage – fluctuations – design of sewers
Sewers and its appurtenances: types of sewers – materials for sewers- appurtenances in sewerage – cleaning and ventilation of sewers.

UNIT – II 12Periods

Hydraulics of sewers and storm drains: Hydraulic Design of Sewers and storm Drains

Sewage Characteristics: Decomposition of Sewage. Sewage characteristics – Physical, Chemical and Biological Characteristics and their testing-BOD-first stage BOD exertion-COD-Relative Stability and Population Equivalent.

Employability

UNIT – III 12Periods

Treatment of sewage - Primary treatment: Screens-grit chambers – grease traps – floatation – sedimentation – design of primary and pretreatment units.

Employability

UNIT – IV 12Periods

Secondary treatment: Aerobic and anaerobic treatment process-comparison.
Suspended growth process: Activated Sludge Process, principles, designs, and operational problems, modifications of Activated Sludge Processes, miscellaneous methods, Oxidation ponds, Oxidation ditches, Aerated Lagoons.
Attached Growth Process: Trickling Filters-mechanism of impurities removal-classification–filter problems-design and operation- recirculation. RBC's, Fluidized bed reactors

Employability

Employability

UNIT –V 12Periods

Anaerobic Processes: Septic Tanks and Imhoff tanks -Principles and Design
Bio-solids (Sludge) management: Characteristics- thickening – digestion , drying and sludge disposal

Employability

Disposal of sewage: methods of disposal – disposal into water bodies- Oxygen Sag Curve-disposal on land.

Employability

TEXT BOOKS

1. Garg, S.K. (2015), "Environmental Engineering (Vol.II): Sewage disposal and Air Pollution Engineering", Khanna Publishers, Delhi 33th Edition.
2. Modi, P.N. (2010), "Sewage Treatment Disposal and Waste Water Engineering" Standard Book House, Delhi, 4th Edition.

REFERENCES

1. Metcalf & Eddy (2002), "Wastewater Engineering: Treatment and Reuse" Tata McGraw-Hill, New Delhi, 4th Edition.
2. Raju, B.S.N. (1995), "Water supply and Waste Water Engineering" McGraw-Hill Education, New Delhi.
3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G, (1985), "Environmental Engineering" McGraw-Hill international edition, New York, 7th Edition.
4. BIS 3025 (Part 44): Method of Sampling and Test (Physical and Chemical) for Water and Wastewater, Part 44: Biochemical Oxygen Demand (BOD) (First Revision)
5. Relevant NPTEL Courses.

REINFORCED CONCRETE STRUCTURES - I

CIV 313 — **Credits : 4**

Instruction : 4 Lectures & 1 Tutorial / week — Sessional Marks : 40

End Exam : 3 Hours — End Exam Marks : 60

Prerequisites:

Engineering Mechanics; Strength of materials; Structural Analysis - I.

Course Objectives:

From this course students will learn the following

1. To understand the recommendations of IS: 456-2000
2. To master the concepts of limit state design
3. To learn how to design various types of beams, columns, slabs and footings

Course Outcomes:

At the end of the course, the students will be able to:

1. Understand the principles of limit state method and design of singly reinforced beams, doubly reinforced beams, flanged beams
2. Enable the students to understand the concept of shear; bond and design shear reinforcement in beams.
3. Enable the students to design one way and two way slabs
4. Enable the students to design columns, footings.
5. Draw the reinforcement detailing for all the structural elements of a reinforced concrete structure.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	3	1			2						2	2		2
	2	2	3	1			2						2	2		2
	3	2	3	1			2						2	2		2
	4	2	3	1			2						2	2		1
	5	2	3	1			1						2	2		2

SYLLABUS

UNIT – I — 12 Periods

Design Philosophies – Working Stress Method, Ultimate Load Method and Limit State Method

Introduction to Limit State Design: Concepts of limit state design- Characteristic loads- Characteristic strength -Partial loads and Material Safety factors- Representative stress-Strain curves- Assumptions in limit state design – Stress block parameters – Limiting moment of resistance.

Singly And Doubly Reinforced Beams: Limit state analysis and design of singly reinforced, doubly reinforced beams.

Employability

UNIT – II 12 Periods

Flanged Sections: Design of T and L beam sections.

Employability

Shear, Torsion and Bond: Limit state analysis and design of sections for shear and torsion – Concept of bond, anchorage and development length, I.S Code provisions. Design examples in simply supported and continuous beams.

UNIT – III 16 Periods

Employability

Slabs: Design of one way slabs – Two way slabs – Continuous slabs using IS coefficients.

UNIT – IV 12 Periods

Employability

Columns: Short and Long columns, Minimum eccentricity, short column under axial compression, column with helical and tie reinforcement. Short columns subjected to uniaxial bending - Short columns subjected to biaxial bending and P-M interaction diagrams. (Only for Internal Assessment)

Employability

UNIT – V 12 Periods

Footings: Introduction: Different types of footings–Design of isolated square and rectangular footings.

Employability

TEXT BOOKS

1. Punmia, B.C., Jain, A.K. and Jain, A. K., "Limit State Design of Reinforced Concrete", Laxmi Publications (P) Ltd., New Delhi, (16th Edition, 2016)
2. Vazirani, V.N., and Ratwani, M.M., "Design of Reinforced Concrete Structures" ,Khanna Publishers., New Delhi,

REFERENCES

1. Varghese, P.C., **"**Limit State Design of Reinforced Concrete", Prentice Hall of India Private Limited" , New Delhi, 2009
2. Pillai, S.U., & Devdas Menon, "Reinforced concrete design", Tata McGraw Hill. New Delhi, (3rd Edition, 2009)
3. Jain, A.K., "Reinforced Concrete Design", Charotor Publications.Anand(Gujarat) (16th Edition, 2016)
4. Ramamrutham, S., "Design of Reinforced Concrete Structures", Dhanpat Rai Publishing Company (P) Ltd. New Dlehi(17th Edition, 2016)
5. B.I.S. 456-2000 "Code of practice for Plain and Reinforced Concrete"
6. Other Relevant B.I.S. Codes
7. Relevant NPTEL Courses.

STRUCTURAL ANALYSIS - II

CIV 314 | **Credits : 3**
Instruction : 3 Lectures & 1 Tutorial / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Prerequisites:

Strength of Materials; Structural Analysis-I.

Course Objectives:

1. Apply suitable methods for analyzing statically indeterminate frames.
2. Apply suitable methods for analyzing Trusses.
3. Apply suitable methods for analyzing Arches and suspension bridges.

Course Outcomes:

At the end of the course the student will be able to

1. Formulate equilibrium & compatibility equations for indeterminate structural members.
2. Analyze statically indeterminate trusses.
3. Analyze statically indeterminate frames.
4. Analyze cables and suspension bridges.
5. Analyze two and three hinged structural members.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3	3	3								1	3	3	
	2	3	3	3	3								1	3	3	
	3	3	3	3	3								1	3	3	
	4	3	3	3	3								1	3	3	
	5	3	3	3	3								1	3	3	

SYLLABUS

UNIT – I 12 Periods

Analysis of statically indeterminate trusses (having not more than 7 members and 3 supports) containing (a) External redundant supports (b) internal redundant members using (i) Method of consistent deformation (ii) Castigliano's theorem – II.

Skill Development

UNIT – II 12 Periods

Analysis of statically indeterminate frames (single storey, single bay portal frames only) using (i) Slope-deflection method (ii) Moment distribution method.

Skill Development

UNIT – III 12 Periods

Analysis of statically indeterminate frames (portal frames with single storey and single bay)

Skill Development

using (i) Kani's method, (ii) Column Analogy method.

Analysis of structures for lateral load using portal method and cantilever method (Only for Internal Assesment)

Skill Development

UNIT – IV 12 Periods

Arches: Normal thrust, radial shear and bending moment in three hinged and two hinged parabolic and segmental arches. Effects of rib-shortening and temperature change.

Skill Development

UNIT – V 12 Periods

Suspension bridges: Stresses in loaded cables with supports at the same and different levels. Length of cable; Two and Three hinged stiffening girders.

Skill Development

TEXT BOOKS

1. Reddy C.S, (2010), "Basic Structural Analysis", Tata McGraw-Hill Education Pvt. Ltd, Third Edition, New Delhi.
2. Prakash Rao D.S, (1996), "Basic Structural Analysis", Universities Press, New Delhi.

REFERENCES

1. Wang C.K, (1982), "Statically indeterminate structures", Tata McGraw-Hill Education Pvt. Ltd.
2. Hibbeler R.C, (2012), "Structural Analysis,6e", Pearson Education, 8th Edition.
3. Bhavikatti S.S, (Vol II -, 2013), "Structural Analysis – II", Vikas Publishing House, 4th Edition.
4. Jindal R.L, (1980), "Indeterminate Structures", S. Chand Publishers, 3rd Edition.
5. Relevant NPTEL Courses.

FLUID MECHANICS - II

CIV 315 | **Credits : 4**

CIV 315	**Credits : 4**
Instruction : 4 Lectures & 1 Tutorial / week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Engineering Mechanics; Fluid Mechanics - I

Course objectives:

1. To understand the design philosophy of turbines and pumps
2. To understand the fundamental concept for methods of dimensional analysis
3. To know the design used for supplying water and generating power

Course outcomes:

At the end of the course, the students will be able to:

1. Apply the principles of modeling pumps, turbines, propellers etc using various dimensionless numbers
2. Determine discharge and design most economical channel section for uniform flow in open channels
3. Use momentum and energy principles for design of turbines and pumps
4. Recommend suitable type of turbines and pumps for the given project.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	2	1								1	2	1	
	2	1	2	3	1						1		1	2	1	
	3	1	2	3	1						1			2	1	
	4		2	2	2						2		1	2	2	

SYLLABUS

UNIT – I 14 Periods

Dimensional Analysis and Similitude: Dimensional Homogeneity - Methods of Dimensional Analysis – Rayleigh's Method – Buckingham's π theorem – Superfluous and Omitted Variables - Similitude – Model Analysis – Dimensionless numbers – Similarity Laws – Model testing of partially submerged bodies – Types of models.

Employability

Boundary Layer Theory: Introduction – characteristics of laminar boundary layer – boundary layer growth over a flat plate (without pressure gradient) – Boundary thicknesses – Stability parameter – Turbulent boundary layer – boundary layer separation – Boundary layer on rough surfaces – laminar sublayer.

UNIT – II 14 Periods

Flow past submerged bodies: Introduction – Types of Drag – Drag on a sphere – Drag on a cylinder – Von Karman Vortex Trail – Drag on a flat plate – Development of Lift on immersed circular cylinder – Magnus effect.

Employability

Impact of Jets: Impulse momentum equation – Momentum Correction factor, Force on Stationary flat plate – moving flat plate - Force on Stationary curved vanes – moving curved vanes.

UNIT – III 14 Periods

Hydraulic Turbines: Introduction - Classification based on Head, Discharge, Hydraulic Action – Impulse and Reaction Turbines, Differences between Impulse and Reaction Turbine, Choice of Type of Turbine, Component Parts & Working principle of a Pelton Turbine, Francis Turbine - Velocity Triangles - Hydraulic and Overall efficiencies.

Employability

Performance of turbines: Performance under Unit head, power and speed – Performance under specific conditions - Specific Speed and its importance. Performance Characteristic Curves – Operating Characteristic Curves – Cavitation - Draft Tube.

UNIT – IV 18 Periods

Centrifugal Pumps: Types of Pumps – Selection Criterion – Comparison between Centrifugal & Reciprocating Pumps - Centrifugal Pumps – Component Parts & Working Principle – Classification of Centrifugal pumps - Cavitation – Maximum Suction lift – NPSH. Specific Speed of pumps – Performance Characteristics of Centrifugal Pumps – Dimensionless characteristics – Constant efficiency curves of Centrifugal Pumps

Reciprocating Pumps: Component Parts – Working Principle of single acting and double acting reciprocating pumps – Discharge Co-efficient, Volumetric efficiency and Slip. Work done and Power Input – Indicator Diagram, Effect of acceleration and friction on Indicator Diagram - Air Vessels.

Employability

UNIT – V 15 Periods

Flow through Open Channels: Classification of open channels, Uniform Flow: Chezy's and Manning's formula, Hydraulic mean depth, hydraulic radius. Most economical trapezoidal and rectangular channel section – Specific energy, Critical Flow.
Steady Rapidly Varied Flow: Hydraulic Jump in a horizontal rectangular channel, Specific force Computation of energy loss.

Employability

TEXT BOOKS

1. Modi, P.N. & Seth, S.M. (2009), "Fluid Mechanics and Hydraulic Machinery", Standard Book House, New Delhi, 19th Edition.
2. Jain, A.K. (2008), "Fluid Mechanics", Khanna Publishers, New Delhi, 4th Edition.

REFERENCES

1. Kumar, K.L., Chand, S. & Co. (2008), "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd, New Delhi, 8th Edition.

2. Subramanya, K. (2008), “Flow in Open Channels”, McGraw Hill Education, New Delhi, 3rd Edition.
3. Chow, V.T. (2009), “Open-Channel Hydraulics”, The Blackburn Press, Caldwell, NJ USA, 1st Edition
4. White, F. M. (2011) “Fluid Mechanics”, Tata McGraw Hill Publication, New Delhi, 7th Edition.
5. Relevant NPTEL Courses.

GEOTECHNICAL ENGINEERING - I

CIV 316 | **Credits : 3**
Instruction : 3 Lectures & 1 Tutorial / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Prerequisites:

Engineering Mechanics; Engineering Geology.

Course Objectives:

1. To impart the fundamental concepts of soil mechanics.
2. To know the importance of index properties like grain size, consistency limits, soil classification
3. To understand the concept of compaction and consolidation of soils

Course outcomes:

By the end of the course, student will be able to:

1. Determine the physical characteristics of soils and use their interrelationships to solve civil engineering problems
2. Determine plasticity characteristics and classify the soil based on Standard codes
3. Analyze the effective stress in soils and determine permeability
4. Analyze the effect of seepage in soils and recommend measures for effective compaction in the field
5. Determine the long term settlements in soils due to consolidation

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	1					1		2			3		
	2	3							1		2			3		
	3	3	2						1		2			3		
	4	3	2			3			1		2			3	3	
	5	3	3			3			1		2			3	3	

SYLLABUS

UNIT - I 12 Periods

Introduction: Origin and Formation of soils; Residual and Transported soils.

Physical Properties of Soil: Three phase system - phase diagram - physical properties-Functional Relationships between physical properties-determination of water content, specific gravity, In-situ density-Relative density and its determination.

Employability

UNIT - II 12 Periods

Plasticity Characteristics of soil: Atterberg's limits and their determination-liquid limit, plastic limit, shrinkage limit and index properties-Activity-Free swell index-Free swell ratio-Swell potential.

Employability

Soil Classification: Soil classification-need and criteria for soil classification-IS Particle size classification-Classification tests-grain size analysis, sedimentation analysis-hydrometer analysis- grain size distribution curves. Unified Soil Classification-AASHTO Classification-Group Index- Indian Standard Soil classification- Coarse grained soils- Fine grained soils-Plasticity chart.

Employability

UNIT - III 12 Periods

Stress Distribution: Stresses due to self weight-total, neutral and effective stresses- Vertical stress due to applied loads- Boussinesq theory- Concentrated load-Strip footing-below centre of circular footing- Rectangular footing-Newmark's influence chart - Pressure bulb-Significant depth- Westergaard theory - 2:1 distribution method

Permeability: types of soil water, Permeability-Darcy's law-Factors effecting permeability-laboratory tests-Average permeability of stratified soils.

UNIT - IV 12 Periods

Seepage Analysis: Seepage pressure-quick sand condition-critical hydraulic gradient-flow nets, properties-uses of flow nets.

Employability

Compaction: Principle of compaction, OMC and MDD, Lab tests-IS light weight and heavy weight compaction tests, factors effecting compaction., zero air void line-effect of compaction on engineering properties of soil, field compaction-compaction equipment based on soils, relative compaction, field tests for compaction control.

Employability

UNIT - V 12 Periods

Consolidation: Definition and significance-mechanism-Terzaghi's soil-spring analogy -lab consolidation test-elog p curve-Coefficient of compressibility-coefficient of volume change-compression index-determination of consolidation settlement - Terzhaghi 1D theory-time settlement calculations. Determination of coefficient of consolidation-time fitting methods-Rectangular hyperbola method- Preconsolidation pressure-normally consolidated and over consolidated clay-Over consolidation Ratio - secondary consolidation.

Employability

TEXTBOOKS

1. Narasinga Rao, B.N.D.(2015), Soil Mechanics and Foundation Engineering, Wiley Publishers
2. Arora, K.R. (2001), "Soil Mechanics and Foundation Engineering", Standard Publishers, Delhi.

REFERENCES

1. Murthy, V.N.S. (2009), "A text book of Soil Mechanics and Foundation Engineering", UBS Publishers Distributors Ltd., New Delhi.
2. Punmia, B.C. (1995) "Soil Mechanics and Foundation Engineering", Laxmi Publications Pvt. Ltd., New Delhi.
3. Braja M. Das, (2005), "Fundamentals of Geotechnical Engineering", Thomson Asia Pvt. Ltd., Singapore.
4. Craig, R.F. (2014), "Soil Mechanics", McGraw hill, New Delhi

5. Gopal Ranjan and Rao,A.S.R. (2007), “Basic and Applied Soil Mechanics”, New age International (P) Ltd, New Delhi.
6. Relevant NPTEL Courses.

GEOTECHNICAL ENGINEERING LAB - I

CIV 317 — **Credits : 2**

Instruction : 3 Practicals / week — Sessional Marks : 50

End Exam : 3 Hours — End Exam Marks : 50

Prerequisites:

Geotechnical Engineering-I (Basics)

Course Objectives:

To enable a student to understand the various index and engineering properties of a soil by experimentation.

Course outcomes:

By the end of the course, student will be able to:

1. Determine the physical and plasticity properties of soils
2. Estimate their behaviour and suitability

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2	2	3	2	1			3	3			2	3	2
	2	2	1	2	2	1	2			2	2			2	2	3

SYLLABUS

LIST OF EXPERIMENTS

1. Determination of hygroscopic water content and specific gravity of soils
2. Grain size distribution - Sieve analysis
3. Hydrometer Analysis
4. Determination of Liquid and Plastic limits (Casagrande method)
5. Determination of Liquid limit (Cone Method)
6. Determination of Shrinkage limit of soil
7. Determination of Optimum moisture content and Maximum dry density (Standard Proctor's)
8. Determination of Permeability by Constant head method
9. Determination of in-situ density by sand replacement method
10. Determination of in-situ density by core cutter method.

Employability

Demonstration experiments

11. Consolidation test
12. Permeability by Variable head method

TEXTBOOKS

1. Narasinga Rao, B.N.D.(2015), "Soil Mechanics and Foundation Engineering", Wiley Publishers
2. Arora, K.R. (2001), "Soil Mechanics and Foundation Engineering", Standard Publishers, Delhi – 110 006.

REFERENCES

1. Punmia, B.C. (1995), “Soil Mechanics and Foundation Engineering”, Laxmi Publications Pvt. Ltd., New Delhi.
2. SP 36: Part 1: 1987 Compendium of Indian standards on soil engineering, Part 1: Laboratory testing of soils for civil engineering purposes, Bureau of Indian Standards, New Delhi
3. Other Relevant I.S. Codes
4. Relevant NPTEL Courses.

ENVIRONMENTAL ENGINEERING LAB

CIV 318 | **Credits : 2**

Instruction : 3 Practical's / week | Sessional Marks : 50

End Exam : 3 Hours | End Exam Marks : 50

Prerequisites:

Engineering Chemistry; Environmental Engineering – I.

Course Objectives:

The course will address the following:

1. Estimation some important characteristics of water and wastewater in the laboratory.
2. It also gives the significance of the characteristics of the water and wastewater.

Course Outcomes:

At the end, the students will be able to:

1. Estimation some important characteristics of water and wastewater in the laboratory.
2. Decide whether the water body is polluted or not with reference to the state parameters in the list of experiments.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	3	3	3	3	3	2	3	2			3	3	3
	2				3	1	3	2	3	3					2	3

SYLLABUS

LIST OF EXPERIMENTS:

1. Determination of pH and Electrical Conductivity of Water.
2. Determination of turbidity in water.
3. Determination of Optimum coagulant dose.
4. Determination and Estimation of total solids, organic solids and inorganic solids and settle able solids by Imhoff Cone.
5. Determination and estimation of Total Hardness–Calcium & Magnesium.
6. Estimation of Acidity in water
7. Estimation of Alkalinity in water
8. Determination of Available and Residual Chlorine content in water
9. Determination of Dissolved Oxygen by Wrinklers Method.
10. Determination of Biological Oxygen Demand by Wrinklers Method
11. Estimation of Iron content in water.
12. Estimation of chloride content in water
13. Estimation of fluoride content in water.
14. Determination of C.O.D.

Employability

REFERENCES

1. Garg S. K. (2001), "Environmental Engineering Vol. I", Khanna Publications, New Delhi, 5th Edition.
2. Sawyer, C.N., McCarty, P.L., and Parkin, G.F. (2000), "Chemistry for Environmental Engineering", Tata McGraw-Hill Publishing Company Limited, New Delhi, 4th Edition.
3. BIS 10500- 1991, Indian Standard DRINKING WATER – SPECIFICATION (Second Revision).
4. BIS 3025 (Part 44): Method of Sampling and Test (Physical and Chemical) for Water and Wastewater, Part 44: Biochemical Oxygen Demand (BOD) (First Revision)
5. Relevant NPTEL Courses.

FLUID MECHANICS LAB - II

CIV 319 | **Credits : 2**
Instruction : 3 Practicals / week | Sessional Marks : 50
End Exam : 3 Hours | End Exam Marks : 50

Prerequisites:

Fluid Mechanics – I & II.

Course Objectives:

The objective of the course is to enable the student to calibrate different types of flow measuring devices to measure flow in tanks, pipes and open channels.

Course Outcomes:

At the end of this course student will be able to

1. Apply principles of impulse moment equation in pipe flows and hydraulic machines.
2. Determine the performance characteristics of hydraulic machines and flow through pipes.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	2	1					2	1			3	1	
	2	3	2	2	1					2	1			3	1	

SYLLABUS

LIST OF EXPERIMENTS:

1. To Study major losses in pipes – Pipe friction – To compute Darcy- Weisbach friction factor.
2. To Study performance characteristics of centrifugal pump
3. To Study performance characteristics of reciprocating pump
4. To Study constant head characteristic curves of Pelton turbine
5. To Study performance characteristics of Francis turbine
6. To compute coefficient of impact of jet on flat and hemispherical vanes
7. To compute Chezy's Constant and Manning's Coefficient of an open channel.
8. To compute energy loss in a hydrualic jump.

Employability

REFERENCES

1. Modi, P.N. & Seth, S.M. (2009), "Fluid Mechanics and Hydraulic Machinery", Standard Book House, New Delhi, 19th Edition.
2. Jain, A.K. (2008), "Fluid Mechanics", Khanna Publishers, New Delhi, 4th Edition.
3. Relevant NPTEL Courses.

TECHNICAL SEMINAR

CIV 3111 | **Credits : 2**
Instruction : 2 Practical / week | Sessional Marks : 50
End Exam : - | End Exam Marks : -

Prerequisites:

Basic Communication Skills; Basics in Civil Engineering.

Course Objectives:

The objective of this course is

1. To enhance the communication skills of the students through participation and giving seminars.
2. To develop an overview of civil engineering and its applications in the students.
3. To promote teamwork and lifelong learning among the students.

Course Outcomes:

At the end of the course the students will be able to

1. Make presentation on a given topic related to civil engineering.
2. Improve the communication skills and cultivate lifelong learning.
3. Broaden their knowledge about Civil Engineering and its practical applications.
4. Update their knowledge on the latest developments in civil engineering.
5. Understand the environmental, safety, economical and sustainability aspects of any civil engineering structure.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2			2		2	2		3	3		2	2	3	2
	2									3	3		2		3	2
	3	2	2	2	2	2	2	2		3				2	2	2
	4		2	2	2	2	2	2		3				2	2	2
	5			2			2	2		3				2		3

OUTLINE OF SYLLABUS

Students have to prepare a report on a case study, design or practical application in civil engineering and make a presentation in teams of maximum 2 students. Duration of each seminar shall be 20 minutes per team including discussion. Evaluation to be done by a Panel of Examiners nominated by HoD with at least one faculty member of specialization related to the seminar topic.

Skill Development

REFERENCES

1. National & International Journals / Standard Magazines / Reports / Case Studies in civil engineering.
2. NPTEL courses in civil engineering.
3. World Wide Web resources on state of the art in civil engineering.

REINFORCED CONCRETE STRUCTURES - II

CIV 321	**Credits : 3**
Instruction : 3 Lectures & 1 Tutorial / week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Reinforced Concrete Structures – I

Course Objectives:

From this course students will learn the following

1. To learn how to design various types of staircase.
2. To learn design of retaining walls.
3. To learn design of piles and pile caps
4. To learn the basic concepts of prestressed concrete.

Course Outcomes:

At the end of the course, the students will be able to:

1. Design and draw the reinforcement detailing of staircase.
2. Design and draw the reinforcement detailing of cantilever & counterfort retaining walls.
3. Design and draw the reinforcement detailing of pile and pile caps
4. Understand the basic concepts of pre-stressed concrete, know the different prestressing systems, analyze the prestressed concrete members and evaluate the losses in prestressing.
5. Understand the structural drawings for practical execution.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	3	1			2						2	2		2
	2	2	3	1			2						2	2		2
	3	2	3	1			2						2	2		2
	4	2	3	1			2						2	2		1
	5	2	3	1			1						2	2		3

SYLLABUS

UNIT – I 12 Periods

Staircase: Introduction - Classification of staircase - Design of dog-legged staircase - design of open well staircase with quarter span landing

UNIT – II 12 Periods

Employability

Retaining Walls: Types of retaining walls - forces on retaining walls - active and passive earth pressure, stability requirements.

Employability

Cantilever Retaining Wall: Preliminary proportioning of cantilever retaining walls. Design of cantilever retaining wall - with horizontal back fill – with horizontal back fill and traffic load – with sloping back fill.

Employability

UNIT – III 12 Periods

Counterfort Retaining Wall: Preliminary proportioning of counterfort retaining walls. Design of counterfort retaining wall.

Employability

UNIT – IV 12 Periods

Piles and Pile caps: Classification of piles - Design of bored cast in situ piles, Pile Caps design for three or four piles.

Employability

UNIT – V 12 Periods

Prestressed Concrete: Introduction - Reinforced Concrete versus Prestressed Concrete - Use of high strength concrete and high tensile steel - Prestressing Systems (Freyssinet, Gifford Udall, Magnel Blaton) - Analysis of simple prestressed rectangular sections (Concentric tendon, Eccentric tendon, Parabolic tendon, Bent tendon) - Prestressing Losses

Employability

TEXT BOOKS

1. Punmia,B.C., Ashok Kumar Jain, and Arun Kumar Jain, (2016), "Limit State Design of Reinforced Concrete" Laxmi Publications (P) Ltd., New Delhi, 16th Edition.
2. Varghese, P.C., (2009) "Advanced Design of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi.
3. Krishnam Raju, N., "Prestressed Concrete", Tata McGraw Hill, New Delhi, 5th Edition.

REFERENCES

1. Pillai, S.U., & Devdas Menon, (2009), "Reinforced concrete design", Tata McGraw Hill, New Delhi, 3rd Edition.
2. Jain, A.K., (2016) "Reinforced Concrete Design", Charotor Publications Anand, Gujarat, 16th Edition.
3. I.S 456 – 2000 "Code of practice for Plain and Reinforced Concrete" 4th Revision, Bureau of Indian Standards, New Delhi, April 2007
4. Relevant I.S. Codes.
5. Relevant NPTEL Courses.

ESTIMATION & COSTING

CIV 322 | **Credits : 3**
Instruction : 3 Lectures & 1 Tutorial / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Prerequisites:

Civil Engineering Materials; Building Technology; Building Planning and Design.

Course Objectives:

1. To understand the types of estimates
2. To understand rate analysis and process of preparation of bills
3. To study about the specification writing
4. To understand the valuation of land and buildings

Course outcomes:

By the end of the course, student will be able to:

1. Estimate the construction cost from the rate analysis
2. Understand about specifications for various items in framed buildings
3. Do the detailed estimate of load bearing and framed buildings

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2		1					2		2	2	2	2	2	
	2	1		2					1		2	2	1	2	2	
	3	2		1					2		2	2	1	2	2	

SYLLABUS

UNIT – I 12 Periods

Introduction: Standard units, Units of measurement of different items of work. Meaning of estimating. Errors in estimation, Different types of estimates. Contingencies and related terms in the estimate, different types of approvals. Plinth area and related terms used in the estimation of various structures, rules and methods of measurements of different works.

Employability

UNIT – II 12 Periods

Specifications: Specifications for framed buildings: Meaning, purpose, types of specifications, Method of preparation of specification, general specification, detailed specifications of different items of framed buildings and other structures.

Employability

UNIT – III 12 Periods

Rate analysis: Data sheet for materials and various items of work in buildings and other structures, schedule of rates, abstract estimate of buildings .

Employability

UNIT – IV 12 Periods

Estimation: Estimation of load bearing structures by Long wall - short wall method and Centre line method.

Detailed estimate of framed buildings - Estimation of Different items of works in substructure, Earthwork, P.C.C, Foundation Concrete, D.P.C in R.C.C building- Single Bedroom, Double Bed Room and Triple bedroom with partition walls and verandah.

Employability

UNIT – V 12 Periods

Estimation of Superstructure: Estimation of various items of R.C.C building works in superstructure: Super structure walls and columns, slab beams, plinth beam, columns, Deductions, Plastering and White Washing and Color Washing, Sloped Roof Buildings; G.I. and A.C. Sheet, Electricity and water supply. Sanitation works etc

Estimation of Prefabricated structures.

Employability

TEXT BOOKS

1. Datta, B.N. (1998), "Estimating and costing", Charator Publishing House.
2. Chakraborti, M. (2001)," Estimating Costing", Specification and Valuation in Civil Engineering.

REFERENCES

1. Birdie .G.S. (2000), "A Text Book on Estimating and Costing", Dhanpat Rai and Sons, New Delhi.
2. Vajarani, V.N. (1997), "Estimating and costing", Khanna Publishers.
3. Bhasin, P.L. (2000), "Quantity Surveying", 2nd Edition, S. Chand & Co.
4. Relevant NPTEL Courses.

GEOTECHNICAL ENGINEERING – II

CIV 323 | **Credits : 3**
Instruction : 3 Lectures & 1 Tutorial / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Prerequisite:

Engineering Mechanics; Geotechnical Engineering – I.

Course Objectives:

1. To understand how to collect site soil information, analyze and interpret
2. To learn about design of various suitable foundation systems depending upon loads and type of soil.
3. To know about the importance of earth slope stability and the applications of earth pressure theories.

Course outcomes:

By the end of the course, student will be able to:

1. Estimate the shear strength parameters of a soil under different drainage conditions
2. Plan soil exploration and analyse and interpret the soil properties
3. Calculate lateral earth pressure on a retaining structure
4. Estimate the allowable bearing pressure of soil needed for the design of shallow foundation
5. Determine the load capacity of piles and analyse the stability of slope of an earth structure

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2			2			1		2			3	2	
	2	3	3		3	3	3		1		2			3	3	3
	3	3	2						1		2			3		
	4	3	2	3			2		1		2			3		2
	5	3	2	3			2		1		2			3		2

SYLLABUS

UNIT – I **10 Periods**

Subsurface Exploration: Introduction – Planning and stages in sub-surface exploration – Methods of exploration – Test pit – Trenches – Geophysical methods: Seismic refraction and Electrical resistivity method – Boring : Auger boring, Wash boring and Rotary drilling – Types of soil sample: disturbed and undisturbed soil samples – Design features of soil sampler affecting soil disturbance – standard penetration test – static and dynamic cone penetration test – bore log report.

Employability

Employability

UNIT – II 12 Periods

Shear Strength: Introduction-Principal stresses and principal planes- Mohr’s circle of stress– Mohr-Coloumb failure theory – Laboratory shear tests – Direct shear test – Triaxial compression test– Unconfined compression test – Vane shear test – Shear strength of saturated cohesive soils – Sensitivity and Thixotropy – Shear strength of cohesionless soils - liquefaction.

UNIT - III 12 Periods

Lateral Earth Pressure – Types of Lateral earth pressure - Rankine’s theory - Active and passive earth pressure for cohesion less and cohesive soils - Earth pressure at rest - Coloumb's wedge theory - Rebhan’s and Culmann’s graphical solutions – Wall friction.

UNIT – IV 12 Periods

Bearing capacity of Shallow footings- definition –Bearing capacity of shallow foundation on homogeneous deposits - Terzaghi’s theory, types of shear failure - Effect of water table, shape of footing, eccentricity of load on bearing capacity- Meyerhof’s theory- Skempton’s theory- Vesic’s theory- I.S.6403 method - Bearing capacity from SPT & SCPT- Allowable Bearing pressure-Causes and methods of minimizing settlement -Plate load test - Permissible Settlements - Differential Settlement.

UNIT – V 14 Periods

Pile Foundations: Introduction- Classification of piles- Load Transfer mechanism-load carrying capacity of pile - static and dynamic formula - pile load test - penetration test - pile groups - Efficiency - Feld's rule - Converse Lebarre formula, Settlement of piles and pile groups - Negative skin friction.

Stability of Slopes: Types of Slopes - types of slope failure– Factor of safety- Procedure for Swedish circle method and method of slices- Bishop’s Simplified method of slices-Friction circle method-Taylor’s stability number.

TEXT BOOKS

1. Narasinga Rao, B.N.D.(2015), Soil Mechanics and Foundation Engineering, Wiley Publishers
2. Arora, K.R. (2001), “Soil Mechanics and Foundation Engineering”, Standard Publishers, Delhi – 110 006.

REFERENCES

1. Gopal Ranjan and Rao, A.S.R. (2007), “Basic and Applied Soil Mechanics”, New age International (P) Ltd.
2. Murthy, V.N.S. (1999), “A text book of Soil Mechanics and Foundation Engineering”, UBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Gopal Ranjan and Rao A.S.R. (2002), “Basic and Applied Soil Mechanics”, New Age International (P) Limited, New Delhi.

4. Punmia, B.C., (1995), “Soil Mechanics and Foundation Engineering”, Laxmi Publications Pvt. Ltd., New Delhi.
5. Swami Saran (1998), “Analysis and Design of sub structures”, Limit State Design, Oxford & IBH Publishing Co. Pvt Ltd., New Delhi.
6. Braja M. Das, (2005), “Principles of Foundation Engineering”, Thomson Asia Pvt. Ltd., Singapore.
7. I.S. 6403 - 1981 Code of practice for determination of bearing capacity of shallow foundations, Bureau of Indian Standards, New Delhi,
8. I.S. SP 36 Part – II - 1988 Compendium of Indian standards on soil engineering, Part 2: Field testing, Bureau of Indian Standards, New Delhi.
9. Relevant NPTEL Courses.

TRANSPORTATION ENGINEERING - I

CIV 324 **Credits : 3**

Instruction : 3 Lectures & 1 Tutorial / week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks : 60

Prerequisites:

Surveying – I & II.

Course Objectives:

The objective of the course is to prepare the student to

1. To know about the history of highway development, surveys and classification of roads.
2. To study about the pavement materials and design the geometric elements of highways.
3. To know about the construction procedure of various types of pavements and study the pavement maintenance.
4. To study about the traffic characteristics and design of intersections.

Course Outcomes:

At the end of the course the student will be able to

1. Carry out surveys involved in planning and highway alignment
2. Design cross section elements, sight distance, horizontal and vertical alignment
3. Design flexible and rigid pavements as per IRC
4. Learn various highway constructions techniques and its maintenance
5. Understand traffic studies, traffic regulations and control.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	2	1								2	3	1	1
	2	3	3	3	2	2	1						2	3	2	1
	3	3	3	3	3	2	1						3	3	3	2
	4	3	3	3	2	1	2						2	3	2	
	5	3	3	3	2	1							2	3	2	3

SYLLABUS

UNIT – I 10 Periods

Highway development and planning – History of Roads - Classification of roads, necessity of highway planning surveys preparation of master plan highway planning in India. Classification of roads, Highway alignment - Factors controlling alignment, Engineering surveys, Drawing & report.

UNIT – II 10 Periods

Highway Geometric Design – Design of Cross sectional elements, Sight distance – Stopping Sight Distance & Overtaking Sight Distance, horizontal alignment – Super elevation & Transition Curves, vertical alignment – Summit Curves and Valley Curves.

Employability

UNIT – III 10 Periods

Pavement Design: Design Of Highway Pavements Design factors; Design of flexible pavements – IRC method,; Design of Rigid pavements - Westergard's stress equation for wheel loads and temperatures stress.

Employability

UNIT – IV 10 Periods

Highway construction and maintenance: Highway materials and their properties and tests - Construction of water bound macadam roads, Bituminous pavements and cement concrete pavements; Construction of joints in cement concrete pavements; Maintenance of highways; Importance of highway drainage; Requirements; Surface drainage; Sub–surface drainage.

UNIT – V 10 Periods

Traffic engineering: Introduction - Traffic characteristics- Road user, vehicular & travel pattern; Traffic studies (Surveys); Traffic Control devices ; Traffic operation- signal design; Types of intersections; Design of rotary intersection; Street lighting.

Employability

TEXT BOOKS

1. Khanna, S.K. and Justo C.E.G. (2015), "Highway Engineering", Nem Chand & Bros, ISBN-13: 978-8185240770.
2. Kadiyali, L.R., (2011), "Traffic engineering and Transport planning", Khanna Publishers, ISBN-13: 978-8174092205.

REFERENCES

1. Chakroborty, P. and Das, A. (2003), "Principles of Transportation Engineering" Prentice Hall of India, New Delhi, 6th Edition.
2. Sharma, R.C. and Sharma, R.K. (2012), "Principles, Practice and Design of Highway Engineering" S Chand & Company, ISBN-10: 8121901316.
3. Relevant NPTEL Courses.

WATER RESOURCES ENGINEERING - I

CIV 325 **Credits : 3**

Instruction : 3 Lectures & 1 Tutorial / week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks : 60

Prerequisites:

Engineering Geology; Fluid Mechanics – II.

Course Objective:

To provide the necessary background for understanding the occurrence and movement of water in hydrosphere and to enable the student to understand Irrigation Engineering Principles and practices.

Course Outcomes:

By the end of the course, the student will be able to

1. Measure and analyze the rainfall in any given area and prepare Intensity-Duration-Frequency curves.
2. Determine the run off in a catchment and prepare the unit hydrograph which in-turn determines the runoff for any given rainfall.
3. Determine hydraulic properties of an aquifer & specific capacity, efficiency and yield of a well.
4. Select a suitable site for the reservoir by conducting investigations and determine the capacity of the reservoir and its operating schedules.
5. Specify appropriate method of irrigation for different crops and cropping patterns and determine the quality and quantity of water required for a crop.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	3		2		1				1		1	3	2	1
	2	3	2	2	1		1				1		1	3	1	1
	3	2	2	1	2		1						1	2	2	2
	4	3	1	3	2		2				2		1	3	2	2
	5	2	2	1			2						1	2		3

SYLLABUS

UNIT – I 12 Periods

Surface Water Hydrology: Water Resources in India, Hydrology in water Resources Planning – Precipitation – Types, Measurement of rainfall, Average depth of rainfall over an area, Mean annual rainfall, consistency of rainfall record – Double mass curve, Infiltration – Factors affecting and its determination, Evaporation and Evapo – Transpiration. Runoff – factors affecting runoff, methods of determination of runoff, stream gauging, hydrograph analysis, base flow separation, unit hydrograph – Hydrograph of different durations, applications of unit hydrograph, S-hydrograph.

Employability

UNIT – II 12 Periods

Ground Water Hydrology: Definitions, sub surface distribution of water, ground water movement, Darcy's law–permeability. Well hydraulics – steady flow in different types of aquifers and wells – determination of hydraulic properties of aquifer, well losses, specific capacity of well, and well efficiency, pumping test and recovery test methods for determination of well yield, Data acquisition by using piezometers.

Employability

Employability

UNIT – III 12 Periods

Reservoir Planning: Types of reservoir investigations for reservoir planning, selection of site for a reservoir, zones of storage in a reservoir, purpose of reservoir, reservoir yield, mass curve and demand curve, determination of reservoir capacity, yield from a reservoir of given capacity, operating schedules, guide curve for reservoir operation, apportionment of total cost of a multipurpose project. Reservoir sedimentation, control of reservoir sedimentation, life of reservoir.

Employability

UNIT – IV 12 Periods

Irrigation: Definition of irrigation, types of irrigation systems – direct and indirect, lift and inundation irrigation system, methods of irrigation – surface and sprinkler methods, drip irrigation, Soil moisture constants, depth of water held by soil in root – zone, Water requirements of crops, duty, delta and base period their relationship, crops – seasons, factors affecting duty and methods of improving duty, consumptive use of water – determination of canal capacities for cropping patterns.

Employability

Employability

UNIT – V 12 Periods

Canal Systems: Classification of irrigation canals – canal alignment, design of unlined canals, regime theories – Kennedy's and Lacey's theories, tractive force method, design problems –balancing depth.

Employability

TEXT BOOKS

1. Punmia, B.C. and Lal Pande B.B. (1992), "Irrigation and Water Power Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 12th edition.
2. Garg, S.K. (1999), Irrigation Engineering and Hydrology Structures, Khanna Publishers, Delhi, 14th Edition.

REFERENCES

1. Modi, P.N. (2004), "Irrigation, Water Resources and Water Power Engineering", Standard Book House, Delhi, 6th Edition.
2. Jayarami Reddy, P. (1999), "A Text book of Hydrology", Laxmi Publication, Delhi.
3. Subramanya, K. (1994), Engineering Hydrology, Tata-Mc Graw Hill Publishing, Delhi, 1st Revised Edition.
4. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - I

SOLID WASTE MANAGEMENT

CIV 326(A) **Credits : 3**
Instruction : 3 Lectures / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Prerequisites:

Environmental Science.

Course Objectives:

The course content enables students to:

1. Develop insight into the collection, transfer, and transport of municipal solid waste.
2. Explain the design and operation of a municipal solid waste landfill.
3. Examine the design and operation of a resource recovery facility.

Course Outcomes:

At the end of the course students are able to:

1. Understand the implications of the production, resource management and environmental impact of solid waste management;
2. Assimilate the significance of recycling, reuse and reclamation of solid wastes;
3. Familiar with relationships between inappropriate waste management practices and impacts on water, soil and sediment quality
4. Design the techniques for efficient solid waste disposal.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	1	3	1	2	-	3	3	2	1	-	1	-	3	3	2
	2	3	3	3	2	3	3	2	1	2	1	2	1	3	2	2
	3	3	2	-	2	2	3	1	2	1	1	3	2	3	3	3
	4	3	-	3	-	-	3	3	3	1	-	3	2	3	2	3

SYLLABUS

UNIT – I 9 Periods

Introduction: Definition of solid waste, garbage, rubbish-Sources and Types of solid wastes. Characteristics of Solid Wastes: Physical, chemical and biological characteristics- Problems due to improper disposal of solid waste.

UNIT – II 9 Periods

Basic Principles: Definition of Solid Waste Management - Reduction, reuse, recycling and recovery principles of waste management - Waste generation and handling at source-Functional elements of solid waste management

UNIT – III 9 Periods

Collection, Transfer and Transport of Wastes: Collection of solid wastes- Collection methods and service. Transfer station-Processing and segregation of the solid waste- various methods of material segregation.

Employability

UNIT – IV 9 Periods

Processing and Transformation of Solid Wastes: Composting: definition-methods of composting-advantages of composting- Incineration: definition- methods of incineration advantages and disadvantages of incineration.

Employability

UNIT – V 9 Periods

Disposal of Solid Waste: Volume reduction, Open dumping, land filling techniques. Landfills: classification-Design and Operation of landfills, Land Farming, Deep well injection.

Employability

TEXT BOOKS

1. George Tchobanoglous, Hilary Theisen and Samuel Vigil (1993), "Integrated Solid Waste Management", McGraw Hill Publishers, USA, 2nd Edition.
2. Peavy, H.S., Rowe, D.R. and Tchobanoglous, G. (2013), "Environmental Engineering", McGraw-Hill, New York, 7th Edition.

REFERENCES

1. Oweis, I.S. and Khera, R.P. (1998), "Geotechnology of Waste Management", PWS Publishing Co., New York, 2nd Edition.
2. Bagchi, A. (2004), "Design of Landfills and Integrated Solid Waste Management", John Wiley & Sons, New Jersey, 3rd Edition.
3. Sharma, H. D. and Reddy, K. R. (2004) "Geoenvironmental Engineering", John Wiley & Sons, New Jersey, 1st Edition.
4. Relevant NPTEL Courses.

ENVIRONMENTAL IMPACT ASSESSMENT

CIV 326(B)	**Credits : 3**
Instruction : 3 Lectures / week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Environmental Sciences.

Course objectives:

The objectives of this course is to

1. To study about the basics, methods of assessment and importance of Environmental Impact Assessment.
2. To know about the Environmental Management and Prediction Methods
3. To study about the Environmental Management Plan
4. The broad education necessary to understand the impact of engineering solutions in global economic, environmental and social context

Course outcomes:

By the end of the course the students will be able to

1. Understand the importance of Environmental Impact Assessment.
2. Implement different methods in preparing an Environmental Impact Statement
3. Identify various mitigation measures that can be used.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3	2	2	3	2	3	2	-	-	2	1	3	3	2
	2	3	2	3	3	2	3	3	3	-	1	3	2	3	2	2
	3	3	-	3	2	3	3	2	-	-	2	2	2	3	3	3

SYLLABUS

UNIT – I 9 Periods

Introduction: Introduction to EIA. Definition of E IA and EIS, preparation of EIS, Elements of EIA, Agency Activities, Environmental setting.

Skill Development

UNIT – II 9 Periods

Environmental attributes: Environmental attributes, air, water, soil, ecology, noise Socio-Economic aspects, Culture and human aspects (Human settlements-Rehabilitations)

Skill Development

UNIT – III 9 Periods

Environmental impacts: Identification, measurement, Aggregation, Secondary and Cumulative Impacts.

Skill Development

UNIT – IV 9 Periods

Skill Development

Impact Assessment Methodology: Criteria for selection of methodology, impact assessment methodologies, procedure for reviewing environment impact statement.

UNIT – V 9 Periods

Case studies: Economic impact analysis, energy production impact analysis, cost benefit analysis, Environmental impact mitigation and control measures.

Skill Development

TEXT BOOKS

1. Ravi Jain, Urban, L.V., Gary S. Stacey and Harold Balbach (2001), "Environmental Impact Analysis", McGraw Hill Professional, New York, 2nd Edition.
2. Anjaneyulu, Y., Valli Manickam (2011), "Environmental Impact Assessment Methodologies", B.S. Publication, New Delhi, 2nd Edition.

REFERENCES

1. Larry W. C. (1996), "Environmental Impact Analysis", Mc. Graw Hill Publishers, New York, 2nd Edition.
2. John Glasson, Riki Therivel and Andrew Chadwick. (2005), "Introduction to Environmental Impact Assessment" Routledge Publication, London, 3rd Edition.
3. Relevant NPTEL Courses.

REPAIR AND REHABILITATION OF STRUCTURES

CIV 326(C) **Credits : 3**
Instruction : 3 Lectures / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Prerequisites:

Engineering Chemistry; Concrete Technology; Reinforced Concrete Structures I & II.

Course Objectives:

1. To learn about the non-destructive testing
2. To know the corrosion control techniques in steel
3. To know about crack control techniques in concrete
4. To adopt different strengthening techniques in concrete structures.

Course outcomes:

By the end of the course, student will be able to:

1. Apply the knowledge of non-destructive testing in practical situation
2. Understand about the various techniques for corrosion control, crack control and strengthening of concrete structures.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	1	1	2	1	-	-	-	1	1	-	3	-	-
	2	3	2	1	1	2	-	-	-	-	1	-	1	3	1	-

SYLLABUS

UNIT – I 9 Periods

Non-destructive strength test

Techniques to test the existing strength- - Destructive tests- core sampling and testing -Non Destructive tests – rebound hammer test, ultrasonic pulse velocity test, pull out test, penetration techniques, acoustic emission techniques.

Employability

UNIT – II 9 Periods

Other non – destructive tests

Chemical test – carbonation and chloride content – Corrosion potential assessment – cover meter survey, half cell potential survey, resistivity measurement
Fire damage assessment – differential thermal analysis – X ray diffraction
Structural integrity/ soundness assessment – radiography, impact echo test, dynamic testing of structures –interpretation and evaluation of test result data

Employability

UNIT – III 9 Periods

Corrosion

Corrosion of reinforcement- Factors affecting corrosion of reinforcement embedded in concrete-Mechanism of electrochemical corrosion-Chloride attack-Carbonation-Corrosion Control.

UNIT – IV 9 Periods

Failures in concrete

Cracks in concrete-types and causes of concrete cracks-Repair of cracks-Common type of repairs-Sealing, Stitching, providing additional steel, Drilling & Plugging-Polymer based repairs-Resin based repairs.

UNIT – V 9 Periods

Strengthening of Reinforced Concrete structures

Retrofitting-Strengthening of structure-Strengthening methods-Jacketing-Beams, Columns-Grouting-External Prestressing.

TEXT BOOKS

1. "Handbook on Repair And Rehabilitation of RCC Buildings", CPWD Published (2002).

REFERENCES

1. Bungey, J. H., Millard, S.G. and Grantham, M.G. (2006), "Testing of Concrete in Structures", Taylor and Francis, London, 4th Edition.
2. Shetty, M. S., (2006), "Concrete technology" S. Chand Publications, New Delhi, 7th Edition,
3. Ghambir, M.L., (2013), "Concrete technology", McGraw-Hill Education, New Delhi, 5th Edition.
4. Neville, A.M. (2011), "Properties of Concrete", Prentice Hall, New Delhi, 5th Edition.
5. Relevant I.S. Codes.
6. Relevant NPTEL Courses.

RS & GIS APPLICATIONS IN CIVIL ENGINEERING

CIV 326(D) **Credits : 3**
Instruction : 3 Lectures / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Prerequisites:

Nil

Course Objectives:

1. To Learn about the principles of remote sensing and Electromagnetic radiations
2. To know about satellites, satellite parameters
3. To learn about the image interpretation and processing techniques
4. To study about GIS and various data models.
5. To know the applications of remote sensing and GIS in civil engineering projects.

Course outcomes:

By the end of the course, student will be able to:

1. Learn about the principles of remote sensing and GIS.
2. Understand about the various image interpretation techniques and image classification techniques.
3. Know about the various applications of remote sensing and GIS in civil engineering projects

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2				3	2	1			2	1	2	2	3	2
	2	2	1		2	2	2	1			2	1	1	2	2	1
	3	2	2	2	1	2	1	2			2	2	1	2	2	3

SYLLABUS

UNIT – I 9 Periods

Remote Sensing – Principle - Electro-magnetic energy, spectrum - EMR interaction with atmosphere – Atmospheric Windows and its Significance – EMR interaction with Earth Surface Materials – Spectral Signature and Spectral Signature curves for water, soil and Earth Surface, Energy sources and radiation principles.

UNIT – II 9 Periods

Satellites - Classification – Satellite Sensors – satellite and sensor parameters - Resolution – Types of sensor systems used in RS, RS satellites, land sat, spot, IRS, IKONOS, QUICKBIRD., RS data products.

UNIT – III 9 Periods

Image interpretation - Elements of image interpretation, concepts of digital image processing image Rectification and Restoration, Image enhancement, Image classification. Characteristics of different platforms, Radar, LIDAR, SAR, MODIS, AMSRE, Sonar remote sensing systems.

Employability

UNIT – IV 9 Periods

Introduction, GIS overview, Introduction to GIS - elements of GIS, Computer hardware - Software. Data Input, Verification, data storage and database management and output applications, Map Overlay - Vector and raster data model , overlay operation Errors and quality control.

UNIT – V 9 Periods

RS and GIS in civil engineering projects: Soil mapping and characteristics. Application in water resource engineering. Environmental pollution monitoring. Regional and urban mapping, planning systems and waste disposal sites.

Employability

TEXTBOOKS

1. Lillesand, T.M. & Kiefer R.W. (2007), "Remote Sensing and image interpretation", John Wiley & Sons (Asia), Newyork.

REFERENCES

1. Anji Reddy, M. (2011), "Remote sensing and Geographical information system", B.S Publications.
2. Burrough, P. A. (1998), "Principles of Geographical information systems for land resource assessment", Clarendon Press, Oxford, 2nd Edition.
3. Stan Aronoff, (1991), "Geographic Information Systems - A Management Perspective", WDL Publications, Ottawa, Canada, Reprint Edition.
4. Kennie, J.J.M., Matthews, (2005), "Remote sensing in Civil Engineering", Mc-Millan.
5. Floyd F. Sabins, (2005), "Remote Sensing Principles and Interpretation", Jr. W.H. Freeman & Co., 3rd Edition.
6. Relevant NPTEL Courses.

URBAN PLANNING AND SMART CITIES

CIV 326(E) | **Credits : 3**
Instruction : 3 Lectures / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Prerequisite:

Building Planning & Drawing

Course Objectives:

To provide exposure to the student in urban planning and smart cities, the latter being the recent development.

Course outcomes:

By the end of the course, student will be able to:

1. Get exposure to the recent trends in urbanization in India and the world
2. Understand the principles of sustainable urban development.
3. Analyze the parameters that define a smart city under Star and ISO 37120 frameworks

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	3	-	3	-	3	3	-	-	2	-	-	2	3	3
	2	2	2	3	2	3	3	3	3	-	2	-	-	2	2	3
	3	3	3	3	3	3	3	3	-	-	3	-	-	3	3	3

UNIT – I 9 Periods

Introduction: Various definitions of town and country planning; Goals and objectives of planning; Components of planning; Benefits of planning;

Definition of Smart City; Evolution of Smart City concept; Smart City components and characteristics

UNIT – II 9 Periods

Urbanization Policies in India: Over view of world urbanization, National Urbanization policy, basic issues in urbanization policy; role of national and state level policies; five year plans, latest attempts at urbanization policy formulation in the country; salient features of the report of the National Commission of Urbanization; Census definition of urban places; functional classification of urban places; India's Smart City Mission

Employability

UNIT – III 9 Periods

Sustainable Urban Development: Changing perspectives in man-environment relationship with focus on issues of population, urbanization, resource depletion and pollution; limits to growth vis-a-vis sustainable economy; growth and environmental imperatives of developing vs. developed countries; definitions, concepts and parameters in sustainable development with particular reference to Brundtland Commission, Agenda 21, Eco-city approach.

Employability

UNIT – IV 9 Periods

STAR Framework of Sustainability: Introduction, Goals & Objectives; Built Environment: Ambient Noise & Light; Community Water Systems; Compact & Complete Communities ; Housing Affordability; Infill & Redevelopment ; Public Parkland; Transportation Choices;

Employability

Climate & Energy: Climate Adaptation; Greenhouse Gas Mi[illegible]ing the Energy Supply; Energy Efficiency; Water Efficiency ; Local Gov GHG & Resource Efficiency; Waste Minimization;

Natural Systems; Green Infrastructure; Biodiversity & Invasive Species; Natural Resource Protection; Outdoor Air Quality; Water in the Environment; Working Lands;

Innovation & Process; Best Practices & Processes; Exemplary Performance; Local Innovation; Good Governance

UNIT – V 9 Periods

ISO 37120 City indicators: Core Indicator requirements; Supporting Indicator requirements; Data Sources; Environment; Solid waste; Transportation; Urban planning; Wastewater; Water and Sanitation; Reporting and record maintenance

Employability

TEXT BOOKS

1. Peter Hall, (2010), "Urban and Regional Planning", Routledge Publishing, 4th Edition.
2. Kulshrestha, S. K., (2012), "Urban and Regional Planning in India - A Handbook for Professional Practice," Sage Publications, New Delhi.

REFERENCES

1. STAR Community Rating System, Version 2.0, October 2016, STAR Communities Washington, DC
2. Sustainable development and resilience of communities-Indicators for city services and quality of life, ISO/DIS 37120, 2013, Switzerland.
3. Relevant NPTEL Courses.

GEOTECHNICAL ENGINEERING LAB - II

CIV 327 | **Credits : 2**
Instruction : 3 Practicals / week | Sessional Marks : 50
End Exam : 3 Hours | End Exam Marks : 50

Prerequisites:

Geotechnical Engineering - I

Course Objectives:

To provide an opportunity to learn how to measure the shear strength and swelling properties of the soil and its importance

Course outcomes:

By the end of the course, student will be able to:

1. Determine the Engineering properties of various soil samples
2. Interpret test results and recommend its suitability in geotechnical practice

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	3	2	2	2			3	3			3	3	2
	2	3	2	2	2	1	2			3	3			3	2	3

SYLLABUS

LIST OF EXPERIMENTS

1. Field identification of soils
2. Relative density – Sand
3. Unconfined compression test for fine grained soils
4. California Bearing Ratio (CBR) Test
5. Direct shear test
6. Swell pressure test
7. Free swell Index
8. Vane shear test

Employability

Demonstration Experiments (Subject to availability)

9. Triaxial Compression Test
10. S.P.T
11. D.C.P.T

TEXTBOOKS

1. Narasinga Rao, B.N.D.(2015), "Soil Mechanics and Foundation Engineering", Wiley Publishers
2. Arora, K.R. (2001), "Soil Mechanics and Foundation Engineering", Standard Publishers, Delhi – 110 006.

REFERENCES

1. Punmia, B.C. (1995), "Soil Mechanics and Foundation Engineering", Laxmi Publications Pvt. Ltd., New Delhi.
2. SP 36: Part 1: 1987 Compendium of Indian standards on soil engineering, Part 1: Laboratory testing of soils for civil engineering purposes, Bureau of Indian Standards, New Delhi
3. Other Relevant I.S. Codes.
4. Relevant NPTEL Courses.

COMPUTER APPLICATIONS IN CIVIL ENGINEERING LAB - I

CIV 328 | **Credits : 2**
Instruction : 3 Practicals / week | Sessional Marks : 50
End Exam : 3 Hours | End Exam Marks : 50

Prerequisites:

Remote Sensing & GIS (Basics)

Course Objective:

The objective of this course is to

1. Maximize the efficiency of planning and decision making
2. Integrate information from multiple sources
3. Eliminate surplus data and minimizing repetition

Course Outcomes:

1. To construct various GIS data models
2. To summarize about project system
3. To executing the applications areas of GIS

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3	3	2	3				2	2	2		3	3	
	2	2	2	2		2				2	2	2		2	2	
	3	2	2	2	2	2				2	2	2		2	2	

SYLLABUS

LIST OF EXPERIMENTS

Exercises in GIS:

1. Digitization of Map/Toposheet
2. Creation of thematic maps
3. Estimation of features and interpretation
4. Developing digital elevation model
5. Simple applications of GIS in civil engineering

Employability

REFERENCES

1. Basudeb Bhatta, (2011), “Remote sensing and GIS”, Oxford Higher Education, New Delhi, 2nd Edition.
2. Anji Reddy, M. (2011), “Remote sensing and Geographical information system”, B.S Publications.
3. P. A. Burrough, (2nd Edition, 1998), “Principles of Geographical information systems for land resource assessment”, Clarendon Press, Oxford.
4. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - II

ADVANCED GEOTECHNICAL ENGINEERING

CIV 412(A) | **Credits : 3**
Instruction : 3 Lectures / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Prerequisites:

Geotechnical Engineering - I, Geotechnical Engineering - II

Course Objective:

The course content enables students to learn the different advanced techniques in Geotechnical Engineering.

Course Outcomes:

At the end of the course the student will be able to;

1. To possess the knowledge of various clay minerals and their structures.
2. Illustrate and design the various components of Well Foundation.
3. Learn the different foundation techniques adopted in expansive soil.
4. Design Retaining Structures in soil.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	1	2	1	-	1	-	1	-	-	2	2	2	1
	2	2	3	3	2	2	1	2	-	2	3	2	3	3	2	3
	3	3	3	3	2	2	1	3	-	2	3	2	3	3	2	3
	4	3	3	3	3	2	1	3	-	2	3	2	3	3	3	3

SYLLABUS

UNIT – I 8 Periods

Clay Minerals: Classification, Structure, properties; Identification of clay minerals - X ray Diffraction, Electron Microscope and Differential Thermal Analysis.

UNIT – II 8 Periods

Well Foundations: Introduction, Caissons, Shapes of well Foundation, Components of Well Foundation, Depth of Well Foundation, Forces acting on Well Foundation, Construction of Well Foundation, Tilting and shifting of Wells.

Employability

UNIT – III 8 Periods

Foundations in Expansive Solis : Introduction, Damage to structures built on Expansive Soil, Factors affecting Seasonal Moisture Variation, Active zone, Mechanism of Swelling, Factors influencing Heave, determination of Swelling Pressure, Foundation Techniques in expansive soil

UNIT – IV 8 Periods

Retaining structures: Introduction, uses, types, stability and design principles of retaining walls, backfill drainage, coffer dams.

Employability

UNIT – V 8 Periods

Braced cuts: Introduction, types of sheeting and Bracing systems, lateral earth pressure on sheeting in sand and clay, Design components of braced cuts.

Employability

TEXTBOOKS

1. Narasinga Rao, B.N.D. (2015), "Soil Mechanics and Foundation Engineering", Wiley Publishers.
2. Arora, K.R. (2001), "Soil Mechanics and Foundation Engineering", Standard Publishers, Delhi.

REFERENCES

1. Gopal Ranjan and Rao,A.S.R. (2007), "Basic and Applied Soil Mechanics", New age International (P) Ltd, New Delhi.
2. Murthy, V.N.S. (2009), "A text book of Soil Mechanics and Foundation Engineering", UBS Publishers Distributors Ltd., New Delhi.
3. Punmia, B.C. (1995) "Soil Mechanics and Foundation Engineering", Laxmi Publications Pvt. Ltd., New Delhi.
4. Braja M. Das, (2005), "Fundamentals of Geotechnical Engineering", Thomson Asia Pvt. Ltd., Singapore.
5. Venkatappa Rao G & Suryanarayana Raju GVS (1990), "Engineering with Geosynthetics", Tata McGraw Hill Publishing Co. Ltd.
6. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - II

DISASTER MANAGEMENT

CIV 412(B) | **Credits : 3**
Instruction : 3 Lectures / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

From this course students will learn the following

1. Learn about the nature of disasters
2. Understand about administrative management of disasters
3. Learn about the importance of pre disaster measures

Course Outcomes:

At the end of the course, the students will be able to:

1. Learn various types of natural & man-made disasters
2. Understand the management system of disasters.
3. Learn the precautionary measures to reduce the disaster damage.
4. Learn about a few of the past disasters in India.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	-	-	-	-	-	2	3	1	1	1	-	-	-	3	1
	2	1	-	1	-	1	3	2	1	2	2	3	2	1	2	3
	3	1	-	2	1	1	1	2	2	3	2	1	-	2	2	3
	4	-	-	-	1	-	2	2	1	1	-	-	1	-	2	1

SYLLABUS

UNIT – I 8 Periods

Disasters - Nature and extent of disasters, Natural disasters like earthquakes, floods, drought, volcanoes, forest fires, hazards, landslides, tsunami, etc. Manmade disasters like chemical and industrial hazards, nuclear hazards, fire hazards etc.

UNIT – II 8 Periods

Skill Development

Disaster Management - Administrative setup and organization, Risk management, strategies of risk reduction, disaster resilience, emergency management programme, Information management.

UNIT – III 8 Periods

Disaster Monitoring & Mitigation - Relief measures (short-term and long-term), financing the relief expenditure, legal aspects, rescue and refugee operations, disaster recovery, mitigation measures.

UNIT – IV 8 Periods

Hazard Analysis - Training of personnel, Emergency facilities and equipment necessary, public awareness creation, Impact of disasters on environment and poverty, health hazards of disasters.

Skill Development

UNIT – V 8 Periods

Case studies - Detailed case studies on Earth-quakes, floods, landslides, industrial hazards and fire accidents in India, INCOIS (Hyd), NIDM (Delhi).

TEXT BOOKS

1. Guptha, H.K. (2001), "Disaster management", University Press, New Delhi, 2nd Edition.
2. Singh, R.B (2000), "Disaster management", Rawat Publications, New Delhi, 2nd edition.

REFERENCES

1. Krishnamurthy, R.R (2002), "Disaster Management", University Press, New Delhi, 1st edition.
2. Seetharaman, S (1999), "Construction Engineering and Management", Umesh Publications, New Delhi, 4th Edition.
3. Gupta, M.C (2002), "Manuals on Natural Disaster management in India", National Centre for Disaster Management, IIPA, New Delhi,.
4. Relevant NPTEL Courses

PROFESSIONAL ELECTIVE - II

AIR POLLUTION CONTROL

CIV 412(C) | **Credits : 3**
Instruction : 3 Lectures / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

The objective of this course is to:

1. To impart the knowledge on air pollution.
2. To analyze causes and effects of air pollution.
3. To familiarize with strategic planning for control of air pollution.

Course Outcomes:

At the end of the course, the students will be able to:

1. Identify the Sources of Air pollutants and its classification.
2. Demonstrate the ability to design and operation of control units.
3. Implement the methods of monitoring the pollution.
4. To effectively utilize the control equipments for controlling the air pollution.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	3	1	2	2	3	3	2		1			3	3	3
	2	3	3	2	2	2	2	3	1					2	3	1
	3	3	3	3	1	2	2	3	1	1				2	2	1
	4	3	3	3	1	3	1	3	1	1		1		3	2	3

SYLLABUS

UNIT – I 9 Periods

Air Pollution and its definition, Factors influencing air pollution, Classification of pollutants particulates, Sources of pollution, Air qualities standards, effects.

Employability

UNIT – II 9 Periods

Meteorology: Wind rose diagrams, lapse rates, mixing depth, atmospheric dispersion, plume behaviour, Effective stack height, stack monitoring and ambient air quality monitoring.

Employability

UNIT – III 9 Periods

Air Pollution effects: On human beings, animals, plants and materials, Air Pollution Episodes in India (Kanpur, Delhi and Agra) and abroad (London, Beijing).

Employability

UNIT – IV 9 Periods

Control of air pollution (Gaseous): Air pollution control equipments (units) such as setting chamber, cyclones, electrostatic precipitators, after burners, absorption, adsorption, Diffusion.

Employability

UNIT – V 9 Periods

Control of air pollution (Particulate): Air pollution control equipments (units) such as wet scrubbers/collectors, scrubbers, centrifugal scrubbers, spray towers, packed beds.

Employability

TEXT BOOKS

1. Rao, M.N. and Rao, H.V.N. "Air Pollution", Tata McGraw Hill Company.
2. Elements of Air Pollution Control by Prof. T. Shivaji Rao
3. Muralikrishna, K.V.S.G. "Air pollution", Kaushal Publications – Kakinada.

REFERENCES

1. Air Pollution Control Technology by T. Painter.
2. Wark and Warner, "Air pollution", Harper & Row, New York.
3. Air Pollution Control by K.V.S.G. Murali Krishna.
4. Fundamentals of Air Pollution by Dr. B.S.N. Raju, Oxford & I.B.H.
5. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - II

SOIL DYNAMICS & MACHINE FOUNDATIONS

CIV 412(D) **Credits : 3**
Instruction : 3 Lectures / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Prerequisites:

Geotechnical Engineering-II

Course Objectives:

From this course students will learn the following

1. To understand the fundamentals of soil dynamics
2. To know the behaviour of the machine foundations and its design
3. To understand the techniques of isolation

Course Outcomes:

At the end of the course, the students will be able to:

1. Solve geotechnical earthquake Engineering problems
2. Study the principles of design of various machine foundations
3. Study the parameters of the soil under dynamic conditions
4. Study about Vibration Isolation

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3	3	2	2	3	-	2	2	2	2	2	3	3	2
	2	3	3	2	2	3	2	-	2	2	2	2	2	2	3	2
	3	3	3	3	3	3	2	-	2	2	3	3	2	2	3	2
	4	3	3	3	3	3	2	-	3	2	3	2	2	3	3	2

SYLLABUS

UNIT – I 9 Periods

Employability

Methods of dynamic analysis-Lumped mass method – Procedure for Dynamic analysis of machine foundations-Resonance and its effect – free and forced Vibrations with and without damping – Magnification factor –Logarithmic decrement.

UNIT – II 9 Periods

Natural frequency of foundation – soil system – Barkan's and I.S. methods of determining natural frequency.
Dynamic Properties of Soils: Coefficient of elastic, uniform and non-uniform compression and shear -Determination of dynamic properties of soil-Steady state vibration test, block vibration test, cyclic plate load test.

UNIT – III 9 Periods

Apparent soil mass – bulb of pressure concept – Pauw's analogy of foundation – soil system. Elastic half space theory-elastic half space analogue method-elastic soil spring anlogy.

UNIT – IV 8 Periods

General requirements of machine foundations-Principles of Design of Foundations for Reciprocating, Impact machines, Foundation for Rotary- Low, Medium & High as per IS code.

Employability

UNIT – V 5 Periods

Vibration Isolation Technique; Mechanical isolation - Foundation Isolation - isolation by location - isolation by barriers- active and passive isolation tests.

Dynamic Bearing capacity of shallow foundations; Pile foundations under dynamic loads.

Employability

Employability

TEXT BOOKS

1. Narasinga Rao, B.N.D.(2015), Soil Mechanics and Foundation Engineering, Chapter-22,Pages 927-962 Wiley Publishers
2. Srinivasulu P and Vaidyanathan, C.V. (1976) "Hand-book of machine foundations", Tata McGraw Hill Publications, 28th Reprint, 2014, © Structural Engineering Research Centre, Madras .

REFERENCES

1. Swami Saran, Soil Dynamics and Machine Foundations., Galgotia Publications Pvt Ltd.1999.
2. Shamsher prakash, Gopal ranjan and swami saran, Analysis and design of Foundations and Retaining Structure,M/s Saritha Prakashan., Meerut.
3. Richart hall,Vibrations of soils and Foundation by Richart Hall,Woods Prentice Hall Inc., New Jersey.
4. Punmia, B.C., Soil Mechanics and Foundation Engineering., M/s. Lakshmi publishing co.
5. Relevant I.S. Codes.
6. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - II

OPTIMIZATION TECHNIQUES

CIV 412(E) **Credits : 3**
Instruction : 3 Lectures / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

Course Objectives:

1. To learn about different approaches in civil engineering.
2. To known about formulation of the problem.
3. To understanding problem solution by Linear programming method, duality theory and sensitivity analysis.
4. To know various applications of linear programming with respect to civil engineering.

Course Outcomes:

At the end of the course the student will be able to:

1. To understand the basics of formulation of structural optimization problems.
2. Know about different linear and nonlinear programming methods (NLP).
3. Understand the application of NLP to optimal structural design problems.
4. Formulate a problem based upon different conditions and solve it by appropriate method.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	3	3	3	3	1	-	2	-	1	3	2	1	3	2
	2	3	2	2	3	2	3	-	3	-	1	2	3	1	3	2
	3	3	3	2	3	2	3	-	3	-	1	-	3	-	3	2
	4	3	3	2	3	2	3	-	3	-	1	-	3	-	3	2

SYLLABUS

UNIT – I 12 Periods

Introduction to planning and optimization - Planning process - systems - Systems approach in Civil Engineering - Principles of modelling.

UNIT – II 12 Periods

Linear programming - Formulation of the problem - Graphical solution

Skill Development

UNIT – III 12 Periods

Solution methods of linear programming problems - Standard form of linear programming problems - Simplex method - Simple problems.

Skill Development

UNIT – IV 12 Periods

Applications of linear programming in civil engineering - Transportation - Construction–Structural Design - Pipe network - Water resource planning.

UNIT – V 12 Periods

Non-Linear programming: Deterministic Methods - Unconstrained and constrained Optimization - Kuhn-Tucker conditions, Direct search and gradient methods - One dimensional search methods - DFP and BFGS algorithms.

TEXT BOOKS

1. Rao. S.S, (2014), "Engineering optimization", Fourth edition, John Wiley & Sons.
2. Kranthiswamy, (2016), "Operations Research Perspectives", Elsevier.

REFERENCES

1. Haftka, R.T. and Gurdal, Z., (1992),"Elements of Structural Optimization", Third Revised Edition, Kluwer Academic Publishers.
2. Arora, J.S, (2004), "Introduction to Optimum Design", Second Edition, Elsevier.
3. Relevant NPTEL Courses.

PROJECT PLANNING & MANAGEMENT

CIV 413 | **Credits : 3**
Instruction : 3 Lectures & 1 Tutorial / week | Sessional Marks : 40
End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

From this course students will learn the

1. Role and responsibilities of a project manager
2. Importance of project management in civil engineering projects
3. Management of resources in construction project
4. Understand labour problems and legislation in India

Course Outcomes:

At the end of the course, the students will be able to:

1. Prepare the schedule of actives in a construction project
2. Estimate project completion time using different techniques namely CPM and PERT
3. Prepare tender quotation for a construction project

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	2	2	1				2	2	3	2	2	1	
	2	3	3	2	2	3				2	2	3	3	1	3	1
	3	3	3	2	2	1	2		2	2	2	3	2	1	2	2

SYLLABUS

UNIT – I 12 Periods

Planning and Scheduling: Introduction, Project management, Steps involved in planning; Objectives; Principles; Advantages; Limitations; Stages of planning; Scheduling, Preparation of construction schedules; Methods of scheduling; Bar charts; Mile stone charts; Controlling; Job layout; Factors affecting job layout; Project work break down; Activities involved; Assessing activity duration.

Project Management Through Networks: Objectives of network techniques; Fundamentals of network analysis; Events; Activities; Dummies; Types of networks; Choice of network type; Advantages of network techniques over conventional techniques.

Employability

UNIT – II 12 Periods

Program Evaluation and Review Technique (PERT): Introduction; Time estimates; Earliest expected time; Latest allowable occurrence time; Slack; Critical path; Probability of completion time for a project.

Critical Path Method (CPM): Introduction; Difference between CPM and PERT; Earliest event time; Latest event time; Activity time; Float; Critical activities and critical path.

Employability

Employability

UNIT – III 10 Periods

Cost analysis: Direct and indirect costs, operation time, Normal and crash points, optimising project cost, crash limit, Free float limit, Optimisation.

Employability

Updating – Process of updating; when to update

Resource scheduling – Resource smoothening, Resource levelling, circle notation and arrow notation.

Employability

UNIT – IV 10 Periods

Contracts: Definition, Conditions of contract, Contract document, Piece work Agreement form, work order; Types of contracts – Lumpsum contract; Lumpsum and schedule contract, Item rate contract, sub-contracts, joint ventures, Contract system with tenders – Definitions – Contractor, Quotation, Earnest money, Security money, Tender, Tender notice, Tender form.

Employability

Employability

UNIT – V 12 Periods

Management – Scope of the Construction Management, Significance of Construction management, Concept of Scientific Management, Qualities of Manager.

Organisation – Authority, Policy, Recruitment process and Training Development of Personnel Department, Labour problems, Labour legislation in India.

Employability

TEXT BOOKS

1. Punmia. B.C. and Khandelwal, K.K. (2016) “Project Planning and Control with PERT and CPM “, Laxmi Publications Ltd., New Delhi, 4th Edition.
2. Sengupta. B, Guha. H (2004), “Construction Management and Planning”; Tata Mc Graw Hill Publishing Company Ltd., New Delhi. 1st Edition

REFERENCE BOOKS

1. Srinath, L.S,(2001) “PERT & CPM Principles and Applications”;Affiliated East West Press, 3rd Edition.
2. Dutta, B.N.(2016), “Estimating and Costing in Civil Engineering”, Charator Publishing House 28th Edition.
3. Relevant NPTEL Courses.

STEEL STRUCTURES

CIV 414 | **Credits : 3**

Instruction : 3 Lectures & 1 Tutorial / week | Sessional Marks : 40

End Exam : 3 Hours | End Exam Marks : 60

Prerequisites:

Engineering Mechanics, Strength of materials, Structural Analysis

Course objectives:

The objective of this course is to

1. Familiarize students with different types of connections and relevant IS codes
2. Understand the design concepts of tension and compression members
3. Familiarize students with concepts of design of flexural members
4. Understand the design concepts of plate girder
5. Familiarize students with different types of column bases and their design

Course outcomes:

At the end of this course the student will be able to

1. Work with relevant IS codes
2. Student will able to design the connection in given situation
3. Carryout analysis and design of various structural member under tension, compression and flexure
4. Analyze & design plate girders for given conditions

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3						1			2	3	2	3	2	
	2	3	3	3	3		1	2	1	2	1	2		3	2	1
	3	3	3	3	3		2	2	1	2	1	2		3	2	1
	4	2		1	1		1			2	2	2		2		

SYLLABUS

Note: All the designs should be in the limit state design method as per IS 800-2007

UNIT – I 12 Periods

Introduction: Fundamentals of Design philosophies, Concepts of limit state design of structures, Different types of rolled steel sections. Stress – Strain relationship for mild steel.

Bolted connections: Behaviour of bolted joints, Design strength of ordinary black bolts, high strength friction grip bolts, Simple connections (subjected to only axial load), Eccentric bolted connections (Type - I & Type - II)

Employability

UNIT – II 12 Periods

Welded Connections: Advantages of welded joints, Types and properties of welds, Types of joints, weld specifications, Simple connections (subjected to axial load), Eccentric welded connections (Type - I & Type - II)

Tension members: Design of angles and other sections for tension.

Employability

Employability

UNIT – III 12 Periods

Compression members: Design of axially loaded compression members, built up compression members, Laced and Battened columns. Column splices

Employability

UNIT – IV 12 Periods

Column bases: Allowable stress in bearing, Slab base, Gusset base

Beams: Beam types, section classifications, lateral stability of beams, Allowable stress in bending, shear and Bearing stresses, Effective length of compression flange, laterally supported and unsupported beams..

UNIT – V 12 Periods

Plate girders: Design considerations, IS Code of recommendations, Design of welded plate girder, Stiffeners and their connections

Employability

TEXT BOOKS

1. Duggal, S.K. (2014) "Limit State Design of steel structures", McGraw Hill Education Private Ltd.
2. Subramanian, N. (2011) "Design of Steel structures", Oxford University Press.

REFERENCES

1. Ramarmutham, S (2014), "Design of steel structures", Dhanpat Rai Publication company.
2. Sai Ram, K.S. (2015) "Design of steel structures", Pearson Education India.
3. Bhavikatti, S.S. (2014) "Design of steel structures by Limit State Method as per IS: 800-2007", IK International Publishing House.
4. IS 800 – 2007, "Indian Standard Code of Practise for General Construction in Steel" Bureau of Indian Standards.
5. Relevant NPTEL Courses.

WATER RESOURCES ENGINEERING - II

CIV 415 **Credits: 3**

Instruction: 3 Lectures & 1 Tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Fluid Mechanics – II; Water Resources Engineering - I

Course Objective:

To provide the necessary background for understanding the storage of water, various Head, Regulation and Cross drainage works and Hydel Power production.

Course Outcomes:

By the end of the course, the student will be able to

1. Select a suitable site for construction of dam, conduct preliminary investigations and check the stability of the gravity dam through stability analysis.
2. Design earth dam that has a controlled seepage from its body and foundation and design suitable spillways.
3. Determine the necessity of diversion head works and design weirs on permeable foundations.
4. Determine the necessity of regulatory works on canals, determine the location of falls and design different types of falls.
5. Suggest suitable river training works wherever necessary and to assess the availability of Hydel power and its utilization.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	3		3	1	1	2		3	1	1	1	3	2	2
	2	3	2	2	1	1	1			3	1		1	3	1	1
	3	2	2	1	3	1	1	1		2		1	1	2	2	1
	4	3	1	3	3	1	2	1		3	2	2	1	2	2	2
	5	2	2	1			2	2					2	2		2

SYLLABUS

UNIT– I 12 Periods

Storage Works: Classification of dams, factors governing selection of type of dam, selection of site, preliminary investigations.

Gravity Dams: Types, Forces acting on a gravity da Employability teria, modes of failure, elementary and practical profiles, stability analysis, stress analysis, Construction joints, openings in dams - galleries, foundation treatment of gravity dam.

UNIT– II 12 Periods

Earth Dams: Types, foundation for earth dams, causes for failure of earth dams, criteria for safe design, phreatic line, seepage analysis – seepage control through body and foundation.
Spillways: Essential requirements, spillway capacity, components, types of spillways and their working, design of ogee spillway, spillway crest gates, energy dissipation below spill way, scour protection, use of hydraulic jump as energy dissipater.

Employability

UNIT – III 12 Periods

Diversion Head Works: Location and components, effects of construction of weirs on permeable foundation, Bligh's, Lane's and Khosla's theories, weirs and barrages, weirs on permeable foundations, design of weir, silt control devices.

UNIT – IV 12 Periods

Regulation Works: Canal falls, definition, necessity and location, classification of falls, design principles of notch fall (Sarda Type & Trapezoidal Type), canal head regulator, cross regulator and off-take alignment.

Employability

Cross Drainage Works: Types, factors affecting the suitability of each type, classification, design principles of Aqueduct (Type-III).

Employability

UNIT – V 12 Periods

Water Power Engineering: Development of hydro power in India, assessment of available power, utilization factor, load factor, diversity factor, storage and pondage, types of hydro power schemes, components of hydel schemes – forebay, intake structure, trash racks, water hammer, surge tanks, substructure and super structure of power house.

Employability

River Engineering: Classification of Rivers, River Training and its objectives, Classification of River Training Works, Methods for River Training, Marginal Embankments or Levees, Guide Banks or Guide Bunds, Groynes or Spurs, Cut-offs, Bank Pitching and Launching Aprons, Pitched Islands, Miscellaneous Methods.

Employability

TEXT BOOKS

3. Punmia, B.C. and Lal Pande B.B. (1992), "Irrigation and Water Power Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 12th edition.
4. Garg, S.K. (1999), Irrigation Engineering and Hydrology Structures, Khanna Publishers, Delhi, 14th Edition.

REFERENCES

5. Modi, P.N. (2004), "Irrigation, Water Resources and Water Power Engineering", Standard Book House, Delhi, 6th Edition.
6. Relevant NPTEL Courses.

TRANSPORTATION ENGINEERING - II

CIV 416 **Credits: 3**

Instruction: 3 Lectures & 1 Tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Nil

Course Objective:

1. To study various components and their functions in a railway track.
2. To acquire design principles of geometrics in a railway track.
3. To study various elements in points and crossings.
4. To acquire design principles of airport geometrics and pavements.

Course Outcomes:

At the end of the course the student will be able to

1. Know the components of permanent way and their functions.
2. Design geometrics in a railway track.
3. Understand the various points and crossings.
4. Know the airport pavement orientation, various visual aids and air traffic control.
5. Understand the basic elements of port and harbors

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	1	1		1						1	3	2	3
	2	3	2	3	2								1	3	2	3
	3	3	2	1	1								2	3	2	3
	4	3	2	2	3		1						2	3	2	3
	5	3	1	1	1		2						1	3	2	3

SYLLABUS

UNIT – I 12 Periods

RAILWAY ENGINEERING – 1: Role of railways in transportation - classification of modes - Comparison of railway and highway transportation - Historical development of railways in India - Advantages of Railways – Classification of Indian Railways – Engineering Surveys for Track Alignment – Obligatory points – Gauges in railway track - Permanent way - Components and their functions – Types of Rails - Rail joints – Welding of Rails – Creep of Rails – Rail fixtures & Fastenings - Coning of Wheels.

UNIT – II 12 Periods

RAILWAY ENGINEERING – 2: Track alignment – requirements of good alignment, factors in selection of good alignment; Geometric design of the track – Gradients and Grade

Employability

Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal/Vertical Curves.

UNIT – III 12 Periods

RAILWAY ENGINEERING – 3: Points and crossings – Necessity – Types, component parts and their functions; Track junctions – types of track junctions; Track drainage – Layout of Railway stations and yards – Signals – Interlocking – Track circuiting – Track Maintenance.

UNIT – IV 12 Periods

AIRPORT ENGINEERING: Layout of Airports – Components functions – Aircraft characteristics – Airport site selection – Airport obstructions and zoning – Runway design – Visual aids – Air traffic control.

Employability

UNIT – V 12 Periods

DOCK & HARBOUR ENGINEERING : Layout of Port components – Functions – Classification of Ports – Site selection – breakwaters - Natural Phenomenon – Tides, Winds, Waves, Currents – Drift – warehouses - Navigational aids.

Employability

TEXT BOOKS

1. Saxena S.C and Arora S.P "Railway Engineering", Dhanapat Rai Publications, 6^{th} Edition, 2004.
2. Khanna, S.K. and Arora, M.G. "Airport Planning and Design" Nemchand & Bros., 6th Edition (1999).

REFERENCES

1. K.P.Subramanian (2003), "Highway, Railway, Airport and Harbour Engineering" Scitech Publications (India) Pvt. Ltd.
2. Rangwala S.C & K.S. "Railway Engineering", Charotar Publications, 14^{th} Edition, 2005.
3. Robert M. Horonjeff, "Planning and Design of Airports", Mc Graw Hill Publications, 2008.
4. Chadula, S.P. "Railway Engineering–A text book of Transportation Engineering", S.Chand & Co. Ltd. (2001).
5. Relevant NPTEL Courses.

COMPUTER APPLICATIONS IN CIVIL ENGINEERING LAB – II

CIV 417 — **Credits: 2**

Instruction: 3 Practicals / week — Sessional Marks: 40

End Exam: 3 Hours — End Exam Marks: 60

Prerequisites:

Reinforced Concrete Structures, Steel Structures

Course Objective:

1. To develop skill to use software to create 2D and 3D models
2. To acquire hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice

Course Outcomes:

1. Ability to use the software packers for drafting and modeling
2. The students will be able to draft the plan, elevation and sectional views of the buildings and truss, using computer software.
3. The students will be able to draft the detailing of basic RC structural elements, using computer software.
4. The student acquires hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	3	3	2	3	1	1	1	2	3	2	2	3	3	1
	2	2	1	2	1	3				2	2	2	2	3		
	3	2	1	2	1	2				2	2	2	2	3		
	4	2	2	2	2					2	2	2	2	3		

LIST OF EXPERIMENTS

STAAD PRO:

1. Analysis and design of beams
2. Analysis and design of 2D portal frame
3. Analysis and design of 3D portal frame
4. Analysis and design of truss
5. Analysis and design of 2D Gable frame

Employability

AUTOCAD + 3D Home Architect:

1. Drawing of reinforcement detailing of basic RC structural elements (Beams, Column, Slab, Footing and Staircase)

Employability

2. Drawing of isometric projections of standard rolled steel sections
3. 3D Home architect – create 2D plans
4. 3D Home architect – create 3D model
5. 3DHome architect – render & walk through

REFERENCES

1. Krishnamoorthy, C.S. and Rajeev, S., Computer Aided Design and Analytical Tools, Narosa, 1993
2. Relevant NPTEL Courses.

TRANSPORTATION ENGINEERING LAB

CIV 418 — **Credits: 2**

Instruction: 3 Practicals / week — Sessional Marks: 40

End Exam: 3 Hours — End Exam Marks: 60

Prerequisite:

Transportation Engineering – I, Geotechnical Engineering - II

Course Objective:

1. To perform tests on road aggregates.
2. To demonstrate the Marshall Stability test.
3. To perform tests on bitumen.
4. To perform tests on soil.

Course Outcomes:

At the end of the course the student will be able to

1. To know the properties of the aggregates.
2. To know the properties of the bitumen.
3. To know the properties of the soil.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	1	1	2		1			2			2	2	2	2
	2	3	1		2		1	1		2			2	2	2	3
	3	3	1	2	2		1			2			2	3	2	3

SYLLABUS

1. **Testing of Aggregates** : Specific gravity – Sieve Analysis – Shape test – Flakiness Index – Elongation Index – Angularity Number – Aggregate Crushing value – Impact value – Abrasion value – Stripping value & Soundness.
2. **Testing of Bituminous material**: Specific gravity – Penetration value – Viscosity value – Softening point – Ductility value – Flash and Fire point.
3. **Design of bituminous mix by** Marshall Stability Test.

Employability

REFERENCES

1. Khanna S. K. & Justo, C. E. G. (1973), "Highway Engineering" Nemchand & Brothers, Roorkee, (3rd Edition).
2. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - III

PRESTRESSED CONCRETE

CIV 421(A) **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Pre-requisites:

Strength of materials, Concrete technology, Reinforced Concrete Structures

Course objectives:

The objective of this course is to

4. To know the different pre-stressing systems and the losses in pre-stressing
5. To analyse and design the sections for flexure and shear.
6. To evaluate the stresses at the end blocks of a pre-stressed member

Course Outcomes:

At the end of the Course, the Student will be able to:

1. Understand the materials required and pre stressing systems.
2. Calculate the loss of pre-stress and analyse stresses in pre-stressed section
3. Design the section for flexure and shear.
4. Design of end blocks for pre and post tensioned sections

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	1	1	2	-	1	-	-	2	-	-	2	2	2	2
	2	3	1	-	2	-	1	1	-	2	-	-	2	2	2	3
	3	3	1	2	2	-	1	-	-	2	-	-	2	3	2	3
	4	3	1	-	2	-	1	1	-	2	-	-	2	2	2	3

SYLLABUS

UNIT – I 12 Periods

Introduction

Historic development – General principles of pre-stressing – pre-tensioning and post tensioning – Advantages and limitations of pre-stressed concrete – Materials – High strength concrete and high tensile steel and their characteristics.

Prestressing Methods: I.S.Code provisions, Methods and Systems of Pre-stressing; Pre-tensioning and post tensioning methods – Different systems of pre-stressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford Udall System.

Employability

UNIT – II 12 Periods

Losses of Prestress

Loss of pre-stress in pre tensioned and post tensioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage bending of member an[illegible]es.

Employability

UNIT – III 12 Periods

Analysis of Sections for Flexure

Analysis of sections for flexure; Elastic analysis of concrete beams pre-stressed with straight, Concentric, eccentric, bent and parabolic tendons.

Employability

UNIT – IV 12 Periods

Design of Sections for Flexure and Shear

Allowable stress, Design criteria as per I.S.Code – Elastic design of simple rectangular and I-section for flexure, shear, and principal stresses.

Employability

UNIT – V 12 Periods

Analysis of End Blocks

Employability

Analysis of end Blocks by Guyon's method and Magnel method, Anchorage zone stress – Approximate method of design – Anchorage zone reinforcement – Transfer of pre- stress in pre-tensioned members.

TEXT BOOKS

1. Krishna Raju N. (2012) "Prestressed Concrete", Tata Mc.Graw Hill Publications, 5th Edition.
2. Ramamrutham S. (2015) Prestressed Concrete, Dhanpatrai Publications, 4th Edition.

REFERENCES

1. Lin T.Y, and Ned H. Burns, (2010) "Design of Prestressed Concrete Structures", Wiley Publications
2. Rajagopalan. N (2006) "Prestressed Concrete", Narosa publications, 2nd Edition.
3. I.S. 1343-2012 "Indian Standard Code of Practise for Prestressed Concrete", Bureau of Indian Standards.
4. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - III

ADVANCED FLUID MECHANICS

CIV 421(B) **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Fluid Mechanics – I & Fluid Mechanics – II

Course Objectives:

1. To develop an insight into engineering problems related to fluids.
2. Student is expected to learn about the viscous effects on fluid motion to solve complex problems in engineering.
3. Student shall be able to know different types of fluid flows and apply the principles of conservations of mass, momentum and energy.

Course Outcomes:

By the end of the course the student will be able to

1. Understand the viscous effects on fluid motion.
2. Compute the forces on submerged bodies and induced drag on bodies.
3. Analyze canal transitions using the principles of momentum and energy conservation.
4. Analyze gradually varied flow in open channels.
5. Analyze unsteady fluid flow in open channels.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	2	2	-	1	2	-	1	1	1	1	2	2	2
	2	2	3	2	1	-	2	2	-	2	1	1	2	2	2	2
	3	2	1	1	2	-	2	2	-	2	1	1	2	2	2	2
	4	2	1	2	2	-	1	2	-	1	1	1	2	2	1	2
	5	2	2	1	2	-	1	2	-	1	1	-	2	2	2	1

SYLLABUS

UNIT – I 9 Periods

Viscous Effects on Fluid Motion: Navier-Stokes Equations (No Derivation) – N.S. equations for standard cases of Plane Two Dimensional and Axisymmetric Flows. Steady Flow between Parallel Plates- Couette and Poiseuille Flows- Unsteady Laminar Flow Past a Flat Plate,Flow through a Circular Annulus- Flow without and with Pressure Gradient-Hagen-Poiseullie Equation, Relationship between Friction factor and Reynolds Number for Laminar Flow through Pipes.

UNIT – II 9 Periods

Drag, Lift & Propulsion: Drag of immersed bodies - Variation of Drag Coefficient with Reynolds Number; Resistance diagram for bodies of revolution- Drag Coefficient of Practical Bodies. Effect of Circulation in Irrotational Flow- Computation of Lift Force- Lift on Airfoil- Lift Coefficient and its Variation with Angle of Attack- Jukowsky Profile- Polar Diagram- Stall - Induced Drag

Skill Development

UNIT – III 9 Periods

Uniform Flow in Open Channels: Uniform Flow Computation- Conveyance of a Channel Section – Section Factor and Hydraulic Exponent. Flow Characteristics in a Closed Conduit with Open Channel Flow. Determination of Normal Depth and Velocity. Design of Channels for Uniform Flow – Design of Non-erodible Channels (Rectangular & Trapezoidal Sections only). Canal Transitions- Change of Depth in Channels with (a) Change in Cross-section and (b) Hump in the Bed- Control Sections- Venturi Flume and Parshall Flume.

Skill Development

UNIT – IV 9 Periods

Varied Flow in Open Channels: Definition of G.V.F. and Derivation of Governing Equation- Mild, Steep, Critical, Horizontal and Adverse Slopes- Classification of G.V.F. Profiles- Backwater and Drawdown Curves- G.V.F. Profiles for Channels with Changing Slopes. Computation of G.V.F. Profiles- Graphical Integration Method and method of Direct Integration (Procedures Only), Direct Step and Standard Step Methods – Computation of G.V.F. Profiles in rectangular channels using Direct and Single Step methods (Simple Slope cases only).

UNIT – V 9 Periods

Unsteady Flow in Open Channels: Gradually Varied Unsteady Flow –Dynamic Equation for Unsteady Flow – Monoclinical Rising Wave –Dynamic Equation for Uniformly Progressive Flow. Wave Profile of Uniformly Progressive Flow- Dam Break Problem - Wave Propagation.(Solution of Unsteady-flow equations and Spatially varied Unsteady Flow are excluded). Rapidly Varied Unsteady Flow - Uniformly Progressive Flow – Moving Hydraulic jump – Positive and Negative Surges–Pulsating Flow.

TEXT BOOKS

3. Modi, P.N.& Seth, S.M. (2009),"Fluid Mechanics and Hydraulic Machinery", Standard Book House, New Delhi, 19th Edition.
4. Subramanyam, K. (2008), "Flow in Open Channels", McGraw Hill Education, New Delhi, 3rd Edition.

REFERENCES

6. Jain, A.K. (2008), "Fluid Mechanics", Khanna Publishers, New Delhi, 4th Edition.
7. Kumar, K.L., Chand, S. & Co. (2008), "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd, New Delhi, 8th Edition.
8. Chow, V.T. (2009), "Open-Channel Hydraulics", The Blackburn Press, Caldwell, NJ

USA, 1st Edition
9. White, F. M. (2011) "Fluid Mechanics", Tata McGraw Hill Publication, New Delhi, 7th Edition.
10. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - III

ADVANCED DESIGN OF STRUCTURES

CIV 421(C) **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Strength of materials, Concrete technology, Reinforced Concrete Structures, Steel Structures

COURSE OBJECTIVES:

From this course students will learn the following

1. To learn how to design RCC water tanks and Concrete bridges
2. To learn how to design plate girders
3. To analyse beams and frames

COURSE OUTCOMES:

At the end of the course, the students will be able to:

1. Design and draw the reinforcement detailing of RCC underground water tanks, tanks resting on ground, and overhead tanks.
2. Design and draw the reinforcement detailing of RCC concrete bridges.
3. Design and draw the detailing of plate girders
4. Analyse beams and frames by applying the concept of plastic analysis

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	2	2	2	2	2	2	2	2	1	2	2	1	2
	2	3	1	2	2	2	2	1	2	2	2	2	2	2	1	2
	3	3	1	2	2	2	2	2	2	2	2	1	2	2	2	2
	4	3	2	1	2	1	1	-	2	-	-	1	2	2	2	1

SYLLABUS

UNIT – I 12 Periods

Introduction To Working Stress Method: Introduction – Design for bending –Analysis and design of singly reinforced and doubly reinforced beams.

Rectangular RC Water Tanks-I: Introduction – General design requirements according to Indian standard code of practice – Design of on ground and underground water tanks.

Employability

UNIT – II 12 Periods

Rectangular RC Water Tanks-II: Introduction – General design requirements according to Indian standard code of practice –Design of over head water tanks.

Employability

UNIT – III 12 Periods

RC Bridges: Components of a bridge in sub structure and super structure. Classification of bridges. Loads on Highway bridges, IRC loading, Design of slab bridge.

Employability

UNIT – IV 12 Periods

Steel Bridges: Bridges: Classification, Loadings, Types of bridges – Deck Type and Through Type, Design of Through Type Bridge - Stringer, Cross Girders.
Bearings & Expansion Joints: Types of bearings, plate bearing, Rocker bearing, Roller bearing, Knuckle pin bearing. Expansion Joints: Introduction and classification.

Employability

UNIT – V 12 Periods

Plastic analysis: Introduction, Upper and Lower bound theorems, Uniqueness theorem, Shape factor, Load factor; Collapse load for fixed and continuous beams, Collapse load for a frame of single bay single storey frame.s

Employability

TEXT BOOKS

1. Punmia, B.C , Ashok Kumar Jain and Arun Kumar Jain,(2016) "Limit State Design of Reinforced Concrete " Laxmi Publications (P) Ltd. New Delhi, 16^{th} Edition
2. Duggal, S.K. (2014) "Limit State Design of steel structures", McGraw Hill Education Private Ltd.

REFERENCES

1. Varghese, P.C., (2009) " Advanced Reinforced Concrete Design", Prentice Hall of India Pvt.Ltd, New Delhi
2. Ramamrutham, S. (2015) "Design of Reinforced Concrete Structures", Dhanpat Rai publishing company (P) Ltd.
3. Pillai, S.U. & Devdas Menon, (2009) "Reinforced concrete design", Tata McGraw Hill. New Delhi, Third Edition.
4. Jain, A.K., (2016) "Reinforced Concrete Design", Charotor Publications. Anand Gujarat, 16^{th} Edition
5. Subramanian, N. (2011) "Design of Steel structures", Oxford University Press.
6. Relevant Indian Standard Codes
7. Relevant NPTEL Courses

PROFESSIONAL ELECTIVE - III

GROUND IMPROVEMENT TECHNIQUES

CIV 421(D) | **Credits: 3**

Instruction: 3 Lectures / week | Sessional Marks: 40

End Exam: 3 Hours | End Exam Marks: 60

Course Objective

The course content enables students to learn the different techniques for enhancing the properties of soil.

Course Outcomes

At the end of the course the student will be able to;

1. Possess the knowledge of various methods of ground improvement and their suitability to different field situations.
2. Learn the grouting techniques.
3. Learn the concept of Vertical drains, its construction and design principles.
4. Outline the various function of Geosynthetics and its application in Civil engineering
5. Understand the concept of Dewatering Techniques.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	3	2	2	2	2	1	2	2	2	3	3	2	3
	2	3	2	3	2	3	2	2	1	2		2	3	3	3	3
	3	3	2	3	2	3	2	2	1	2	2	2	3	3	3	3
	4	3	2	3	2	3	3	3	1	2	2	2	3	3	3	3
	5	3	2	3	2	3	2	2	1	2	2	2	3	3	3	3

SYLLABUS

UNIT – I 8 Periods

Introduction – Need for Ground Improvement, Objectives of Ground Improvement, Classification of Ground Improvement Methods, Mechanical Stabilization- Triangular Chart Method and Rothfutch Method, Blasting, Dynamic Compaction/ Consolidation.
Cement stabilization- Mechanism, factors affecting and properties, use of additives, design of soil cement mixtures, construction techniques.

UNIT – II 8 Periods

Soil & Foundation Grouting – Grouting Eq[illegible]plications, Classification of grouting based on Materials, Grouting Technique and Sequence of Operation.

Employability

Employability

UNIT – III 8 Periods

Vertical Drains- Preloading, Sand Drains, Prefabricated - Principle, Band Drains or Wick Drain, , Advantages and Disadvantages, Stone columns - Introduction, construction practice, design principles, vibrofloatation techniques and other techniques like dynamic replacement etc.

Employability

UNIT – IV 8 Periods

Geosynthetics-Types, Functions, Applications, Raw materials, Manufacturing methods.
Properties of Geotextiles- Physical Properties, Mechanical Properties, Hydraulic Properties, Survivability and Durability.

UNIT – V 8 Periods

Reinforced Earth – Materials, Applications.
Dewatering- Definition, Objectives, Methods of Dewatering- Open Sumps and Ditches, Well point Systems, Deep Well Systems, Vertical Sand Drains, Electro- Osmosis, cut-off walls.

Employability

TEXTBOOKS

1. Narasinga Rao B.N.D (2015), Soil Mechanics and Foundation Engineering, Wiley Publishers, pp. 963-1038, 1st Edition.
2. Purushothama Raj P. (1999), Ground Improvement Techniques, Lakshmi Publications, New Delhi.

REFERENCES

1. Hausmann Manfred R. (1990), Engineering Principles of Ground Modification, McGraw-Hill.
2. Moseley, M.D. (1998), Ground Treatment, Blackie Academic and Professional.
3. Venkatappa Rao, G. and Suryanarayana Raju, G.V.S. (1990), “Engineering with Geosynthetics”, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - III

BRIDGE ENGINEERING

CIV 421(E) **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Design of Concrete Structures

Course Objective:

1. Familiarize Students with different types of Bridges and IRC standards
2. Equip student with IRC standards
3. Equip student with concepts and design of Slab Bridges
4. Equip student with concepts and design of T Beam Bridges
5. To familiarize student with the knowledge of bridge sub structure

Course Outcomes:

At the end of the course the student will be able to

1. Explain different types of Bridges with diagrams and Loading standards
2. Loading standards
3. Analyze and design the Slab bridges,
4. Analyze and design the T Beam bridges
5. Carryout the stability analysis of Substructure

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	1	2	1	-	-	-	-	-	-	-	1	3	2	3
	2	3	3	2	1	-	-	-	-	-	-	-	1	3	2	3
	3	3	3	3	1	-	-	-	-	-	-	-	1	3	2	2
	4	3	3	3	1	-	-	-	-	-	-	-	1	3	3	3
	5	3	2	3	1	-	-	-	-	-	-	-	1	3	2	3

SYLLABUS

UNIT – I 12 Periods

Introduction: Components of Bridges – Classification – Importance of Bridges -Selection of Bridge site – Economical span – Location of piers and abutments – Choice of bridge type: Subsoil exploration – Scour depth. Importance of Bearings

UNIT – II 12 Periods

Loading Standards: Types of loading - Dead load - Live load (IRC Standards) - Impact Load - Tractive forces - Centrifugal forces - wind forces – temperature stresses – Seismic forces.

Employability

UNIT – III 12 Periods

Slab bridges-introduction- Wheel load on slab- effective width method (IS Method) - slabs supported on two edges- cantilever slabs-dispersion length

Employability

UNIT – IV 12 Periods

Beam & Slab Bridge (T-Beam Girder Bridge): General features – Design of interior panel of slab – Pigeaud's method – Courbon's method – Analysis and design of T-beam longitudinal girder subjected to IRC loading – Analysis and design of Cross Girder

Employability

UNIT – V 12 Periods

Substructure: General features of Abutments – forces acting on abutments – Design and Stability analysis of abutments. General features - Types of piers – Forces acting on piers – Design and Stability analysis of piers. Types of Bearings.

Employability

TEXT BOOKS

1. Johnson victor D, "Essentials of Bridge Engineering", 7th Edition, Oxford, IBH publishing Co., Ltd., 2006.
2. Ponnuswamy, S. (2008), "Bridge Engineering" Mc Graw Hill Inc.

REFERENCES

1. Krishna Raju N., "Design of Bridges", 4th Edition, Oxford and IBH Publishing Co., Ltd., 2008.
2. Jagadish T.R. & M.A. Jayaram, "Design of Bridge Structures", 2nd Edition, 2009
3. Relevant – IRC & Railway bridge Codes.
4. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - IV

ADVANCED TRANSPORTATION ENGINEERING

CIV 422(A) **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Nil

Course Objective:

1. To study the different elements and their functions in layout of port and harbour.
2. To learn the various tunneling methods and its applications.
3. To study the different distresses and highway maintenance of pavements.
4. To study the traffic engineering principles and components of ITS.

Course Outcomes:

At the end of the course the student will be able to

1. Know the various components in port and harbor, and their functions.
2. Understand the various tunneling methods.
3. Know the various distresses in flexible and rigid pavements.
4. To understand the highway maintenance.
5. Learn the traffic engineering principles and components of ITS.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	1	2	2	-	1	1	-	-	-	-	1	2	2	3
	2	3	1	2	1	-	1	1	-	-	-	-	1	2	2	3
	3	3	1	2	3	-	1	-	-	-	-	1	1	3	2	3
	4	3	2	1	1	-	1	1	-	-	-	1	1	3	2	2
	5	3	1	1	1	3	1	1	-	-	-	1	1	3	2	2

SYLLABUS

UNIT – I 9 Periods

DOCK & HARBOUR ENGINEERING : Layout of Port components – Functions – Classification of Ports – Site selection – breakwaters - Natural Phenomenon – Tides, Winds, Waves, Currents – Drift – warehouses - Navigational aids.

Skill Development

UNIT – II 9 Periods

TUNNEL ENGINEERING : Introduction - Alignment of tunnels – Cross-section of tunnels – Construction methods of Tunnels – Tunnel lining – Ventilation – Drainage – Muck disposal.

UNIT – III 9 Periods

HIGHWAY MAINTENANCE: Pavement failures, causes, failures in flexible pavements and rigid pavements. Maintenance of highways, routine maintenance, periodic maintenance, special repairs.

Skill Development

UNIT – IV 9 Periods

TRAFFIC ENGINEERING PRINCIPLES: components of traffic stream: flow-speed-Density, measurement and analysis, q-k-v relationships, design hourly volume, concept of EPCU, capacity and level of service, Parking studies and accident studies.

UNIT – V 9 Periods

INTELLIGENT TRANSPORTATION SYSTEMS: Components of ITS, Traffic Management - Incident Management, Advanced vehicle control and safety systems, Electronic toll collection, Traveller Information System, Benefits and costs of ITS.

Skill Development

TEXT BOOKS

1. Seetharaman "Dock & Harbour Engineering", Umesh Publications, 1st Edition, 2008.
2. Rangwala, K. "Railway, Bridge and Tunnel Engineering", Charotar Publishing House Pvt. Ltd. Second Edition (2016)
3. Khanna, S. K. & Justo, C. E. G. (1973), "Highway Engineering" Nemchand & Brothers, Roorkee, (3rd Edition).
4. Kadiyali, L.R. Traffic Engineering, Khanna Publishers, 7th edition 2007.
5. Pradeep Kumar Sarkar "Intelligent Transport System" PHI Learning Pvt. Ltd. (2017).

REFERENCES

1. Subramanian, K.P. (2003), "Highway, Railway, Airport and Harbour Engineering" Scitech Publications (India) Pvt. Ltd.
2. Srinvasan, Docks & Harbour Engineering, Charotar Publishing House, 7th edition, 1983.
3. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - IV

WATER SHED MANAGEMENT

CIV 422(B) **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Water Resources Engineering – I

Course Objectives:

From this course students will be able to

1. Understand the concept of watershed management
2. Identify the characteristics of watershed
3. Study the principle of soil erosion and methods controls soil erosion
4. Study different techniques for water harvesting
5. Study different factors responsible for land management

Course Outcomes:

At the end of the course, the students will be able to:

1. Calculate watershed parameters and analyse watershed characteristics to take appropriate management action
2. Quantify soil erosion and design of control measures
3. Suggest suitable methods for watershed management
4. Applying land grading management

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	-	-	1	-	1	3	-	2	-	1	2	2	1	1
	2	2	2	3	3	-	2	3	-	2	-	2	2	3	2	2
	3	3	2	2	2	1	3	3	-	3	-	3	2	3	2	3
	4	2	1	1	2	-	2	3	-	2	-	1	1	2	2	1

SYLLABUS

UNIT – I 8 Periods

Introduction: Concept of watershed development, objectives of watershed development, need for watershed development, Integrated and multidisciplinary approach for watershed management.

UNIT – II 8 periods

Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

Skill Development

UNIT – III 8 Periods

Principles of Erosion: Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion- Universal soil loss equation.
Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, Gabion.

UNIT – IV 8 Periods

Skill Development

Water Harvesting: Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, subsurface flow harvesting, stop dams, farm ponds and dugout ponds, percolation tanks.

UNIT – V 8 Periods

Land Management: Land use and Land capability classification, management of forest, agricultural, grassland and wild land, land grading operation, Reclamation of saline and alkaline soils.

Skill Development

TEXT BOOKS

1. Murthy, J. V. S, (2006) "Watershed Management" New Age International Publishers, New Delhi
2. Murthy, V.V.N (2007) "Land and Water Management" Kalyani Publications, New Delhi

REFERENCES

1. Das M.M. and Saikia M.D (2013) "Watershed Management", PHI Learning Pvt. Ltd
2. Wurbs R A and James R A (2002) "Water Resource Engineering", Prentice Hall Publishers Upper Saddle River, N.J.
3. Black P E (1996) "Watershed Hydrology" Prentice Hall, Upper Saddle River, N.J.
4. Relevant NPTEL courses.

PROFESSIONAL ELECTIVE - IV

ADVANCED BUILDING CONSTRUCTION

CIV 422(C) **Credits: 3**
Instruction: 3 Lectures / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Course Objectives:

From this course students will learn the following

1. Learn about advanced developments in building constructions
2. Understand the role of technology in building constructions
3. Learn about the modern electrical installations

Course Outcomes:

At the end of the course, the students will be able to

1. Learn the importance of providing earthquake & fire resistance to buildings
2. Learn the importance of providing acoustic & thermal resistance to buildings
3. Understand the functioning of smart buildings
4. Learn the basics of electrical installations in a building

Mapping of course outcomes with program outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1	2	2	3	1	1	-	-	-	1	1	2	3	1
	2	2	1	2	2	3	1	1	-	-	-	1	1	2	3	1
	3	2	1	1	-	2	2	2	-	-	1	2	-	2	2	2
	4	1	1	3	1	1	1	2	-	-	1	2	-	2	1	2

SYLLABUS

UNIT – I 8 Periods

Earthquake resistant buildings: Occurrence of earthquakes, plate-tectonic theory, seismic waves, magnitude and intensity, seismic zones of India, plan & vertical configurations of buildings, shear walls, dampers, base-isolation, strong column-weak beam concept.

Skill Development

UNIT – II 8 Periods

Fire resistant buildings: Introduction, Importance of fire resistance to buildings, ISO 834 standard heating conditions, grading or classifications, effect of high temperature on steel and concrete, effect of high temperature on different types of structural members.
Fire protection of buildings: Fire zones, general requirements, exit requirements, requirements of residential, educational, business, industrial and storage buildings

Skill Development

UNIT – III 8 Periods

Acoustic buildings: planning and design against outdoor and indoor noise for - residential, educational, office, hostel and industrial buildings.

Skill Development

Thermal Insulated buildings: Introduction, designating thermal properties, Insulation materials, construction techniques for thermal insulation, super Insulation.

UNIT – IV 8 Periods

Smart buildings: materials used in smart systems, different types of smart materials, characteristics and behaviour of smart materials, Components of smart systems, system features and interpretation of sensor data, features of control systems.

UNIT – V 08 Periods

Electrical installations: general requirements, planning of electrical installations for earthing, tele-communication and other miscellaneous services

Installations of lifts & Escalators: essential requirements, design considerations for lifts and escalators

REFERENCES

1. Pankaj Agarwal (2011), “Earthquake Resistant Design of structures”, Prentice Hall of India, New Delhi, 2nd edition.
2. Varghese,P.C (2009), “Advanced Reinforced Concrete Design” , Prentice Hall of India, New Delhi, 2nd edition.
3. SP-7 (1983), National building code of India,Group-1, part-4&8
4. Srinivasan, A. V and Michael McFarland, D (2000), “Smart Structures: Analysis and Design”, Cambridge University Press, New Delhi, 1st edition.
5. William Spence, P (2012), “Construction materials, methods and Techniques”, Cengage learning India pvt ltd, New Delhi, 2nd edition.
6. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - IV

INTRODUCTION TO FINITE ELEMENT METHOD

CIV 422(D) **Credits: 3**

Instruction: 3 Lectures / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Course Objective:

1. To study the strain- displacement and linear constitutive relation.
2. To understand the numerical techniques applied in FEM Establishment of element stiffness and load vector.
3. To study about the 2-D isoperimetric concepts.

Course Outcomes:

On completion of the course, the student will be able to:

1. Demonstrate the differential equilibrium equations and their relationship.
2. Apply numerical methods to FEM.
3. Demonstrate the displacement models and load vectors.
4. Compute the stiffness matrix for isoperimetric elements.
5. Analyse plane stress and plane strain problems.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1	2	2	3	1	1	-	-	-	1	1	2	3	1
	2	2	1	2	2	3	1	1	-	-	-	1	1	2	3	1
	3	2	1	1	-	2	2	2	-	-	1	2	-	2	2	2
	4	1	1	3	1	1	1	2	-	-	1	2	-	2	1	2

SYLLABUS

UNIT – I 12 Periods

Introduction Of Finite Element Method – Concept of an element – Various element shapes**.**

UNIT – II 12 Periods

Displacement Models – Element stresses and strains – Direct formulations of element stiffness and loads**.**

UNIT – III 12 Periods

Plane stress/strain triangular elements – Quadrilateral elements – Modelling and mesh refinement**.**

Skill Development

UNIT – IV 12 Periods

Construction of stiffness matrix and loads – boundary conditions.

UNIT – V 12 Periods

Finite Element modelling and solution techniques – symmetry in Finite Element method– nature of Finite Element method solution – errors/convergence and adaptively.

Skill Development

TEXT BOOKS

1. Krishnamurthy, C.S, (1995), "Finite Element Analysis Theory & Programming", McGraw-Hill.
2. Bhavikatti, S.S. (2015), "Finite Element Analysis", New Age International Pvt. Ltd

REFERENCES

1. Zienkiewcz, O.C., and Taylor, R.L., (2002), "The Finite Element method", Butterworth Heinemann, New Delhi.
2. Cook, R.D., (2002), "Concept and Applications of Finite Element Analysis", John Wiley & Sons.
3. Chandrakant. S. Desai, and John. F. Abel.,(2002), "Introduction to the Finite Element method", CBS Publishers & Distributors, New Delhi.
4. Chandraputla, T.R. and Belegundu A.D., (2003), "Introduction to Finite Elements in Engineering", Prentice Hall, Indian, Edn.
5. Relevant NPTEL Courses.

PROFESSIONAL ELECTIVE - IV

EARTHQUAKE ENGINEERING

CIV 422(E) | **Credits: 3**
Instruction: 3 Lectures / week | Sessional Marks: 40
End Exam: 3 Hours | End Exam Marks: 60

Prerequisite:

Course Objective:

1. To create a strong understanding on application of single degree and multi-degree of freedom systems.
2. To impart the knowledge on causes and effects of earthquakes.
3. To familiarize with seismic codal and detailing provisions.

Course Outcomes:

At the end of the course the student will be able to

1. Students acquire the ability to analyze single and multi-degrees of freedom system of structures.
2. The student will demonstrate the ability to design earthquake-resistant structures.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	1	1	-	-	-	-	-	-	-	1	3	-	1
	2	3	2	2	1	-	-	-	-	-	-	-	1	3	-	1

SYLLABUS

UNIT – I 12 Periods

Introduction: Earthquakes, Epicenter, Hypocenter and earthquake waves, Measurement of ground motion, Seismic Regions, Intensity and Iso-seismals of an earthquake, Magnitude and energy of an earthquake, Consequences of earthquakes, Seismic zones.

UNIT – II 12 Periods

Theory of vibrations – Lumped mass and continuous mass systems – Single Degree of Freedom (SDOF) Systems – Formulation of equations of motion – Un damped and damped free vibration, Multiple Degree of Freedom (MDOF) Systems Formulation of equations of motion – Free vibration – Determination of natural frequencies of vibration and mode shapes

UNIT – III 12 Periods

Plan Configurations – Torsion Irregularities – Re-entrant corners – Non-parallel systems – Diaphragm Discontinuity – Vertical Discontinuities in load path – Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of adjacent buildings.

Skill Development

UNIT – IV 12 Periods

Ductile Detailing: Ductility of R.C structures- Confinement- detailing as per IS-13920-1993- moment redistribution – principles of design of beams, columns – beam column joints – soft story concept.

Skill Development

UNIT – V 12 Periods

Cyclic loading behaviour of RC and steel elements, Base isolation, Retrofitting and restoration of buildings subjected to damage due to earthquakes, effects of earthquakes, factors related to building damages due to earthquake, methods of seismic retrofitting, restoration of buildings.

TEXT BOOKS

1. Pankaj Agarwal and Manish Shri Khande, Earthquake Resistant Design of Structures, Prentice Hall of India, 2007, New Delhi.

REFERENCES

1. Chopra A.K., “Dynamics of Structures”, 5th Edition, Pearson Education, Indian Branch, Delhi, 2007
2. Duggal, S.K. “Earth Quake Resistant Design of Structures”, Oxford university Press, 1st Edition, 2012
3. IS Codes: IS: 1893, IS: 4326 and IS:13920, Bureau of Indian Standards, New Delhi.
4. Relevant NPTEL Courses.

ENGINEERING ECONOMICS & FINANCE

CIV 423 **Credits: 2**

Instruction: 2 Lectures & 1 Tutorial / week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Course Objective:

To explain the basic principles of managerial economics, accounting practices and financial management techniques for effective business decision making and to promote entrepreneurial abilities among the budding engineers.

Course Outcomes:

At the end of the course the student will be able to

1. Understand the economic environment and to give an idea on various concepts of Engineering economics.
2. Gain knowledge about the concepts of cost estimating and financial management.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	1	1		2	2		2	2	1	2	2	2	2	2
	2		1	1		3			2	2	2	3	2	1	3	2

SYLLABUS

UNIT – I 9 Periods

Engineering economics :Basic principles – Time value of money, Quantifying alternatives for decision making, Cash flow diagrams, Equivalence- Single payment in the future (P/F, F/P), Present payment compared to uniform series payments (P/A,A/P), Future payment compared to uniform series payments (F/A,A/F),Arithmetic gradient, Geometric gradient.

UNIT – II 9 Periods

Comparison of alternatives – I: Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return.

Skill Development

UNIT – III 9 Periods

Comparison of alternatives – II: Break-even comparisons, Capitalized cost analysis, Benefit-cost analysis.

Skill Development

UNIT – IV 9 Periods

Depreciation, Inflation and Taxes: Depreciation, Inflation, Taxes.

Equipment economics: Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis.

Skill Development

UNIT – V 9 Periods

Cost estimating: Types of Estimates, Approximate estimates – Unit estimate, Factor estimate, Cost indexes, parametric estimate and Life cycle cost.
Financial management: Construction accounting, Chart of Accounts, Financial statements – Profit and loss, Balance sheets, Financial ratios, Working capital management.

Skill Development

Note: The student is expected to gain only elementary knowledge of the subject. Numerical Problems are for Internal Valuation only.

REFERENCES

1. Bulu Pradhan, "Construction Economics and Finance", NPTEL Course, IIT Guwhati.
2. Peterson, S. J., "Construction Accounting and Financial Management", Pearson Education, Upper Saddle River, New Jersey, 2005.
3. Blank, L. T. and Tarquin, A. J., "Engineering Economy", Fourth Edition, WCB/McGraw-Hill, 1998.
4. Bose, D. C., "Fundamentals of Financial management", 2nd ed., PHI, New Delhi, 2010.
5. Gould, F. E., "Managing the Construction Process", 2nd ed., Prentice Hall, Upper Saddle River, New Jersey, 2002

IRRIGATION STRUCTURES DESIGN & DRAWING

CIV 424 **Credits: 2**
Instruction: 1 Lecture & 3 Practical / week Sessional Marks: 40
End Exam: 3 Hours End Exam Marks: 60

Prerequisites:

Water Resources Engineering – II

Course Objectives:

From this course students will be able to design and draw different hydraulic structures

Course Outcomes:

At the end of the course, the students will be able to:

1. Design and Draw the Canal head regulator
2. Design and Draw the Surplus weir
3. Design and Draw the Type 3 Syphon Aqueduct
4. Design and Draw the Trapezoidal Notch fall
5. Design and Draw the Tank Sluice with tower head

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	2	2		2	1		3	2	1	2	3	1	2
	2	3	2	2	2		2	1		3	2	1	2	3	1	2
	3	3	2	2	2		2	1		3	2	1	2	3	1	2
	4	3	2	2	2		2	1		3	2	1	2	3	1	2
	5	3	2	2	2		2	1		3	2	1	2	3	1	2

SYLLABUS

Design and Drawing of following Hydraulic structures

1. Surplus Weir
2. Canal head regulator
3. Trapezoidal Notch fall
4. Type 3 Syphon Aqueduct
5. Tank Sluice with tower head
6. Typical Irrigation Structure(s) in Andhra Pradesh

Employability

TEXT BOOKS

1. Satyanarayana Murthy. C, (2003) "Water Resources Engineering - Principles and Practice" New age international publishers, New Delhi

REFERENCES

1. Punmia B.C, Pande B.B. (2009) "Irrigation and Water Power Engineering" Laxmi Publications, New Delhi, 16th Edition.
2. Garg, S.K. (2011) "Irrigation Engineering and Hydraulic Structures" Khanna Publishers, New Delhi.
3. Relevant NPTEL Courses

CSE 211 DATA STRUCTURES AND ALGORITHMS CREDITS: 4
INSTRUCTION: 4Theory & 1Tutorial/ Week SESSIONAL MARKS: 40
FINAL EXAM: 3Hrs FINAL EXAM MARKS: 60

Objectives:

The course should enable the students:
1. To acquire knowledge on several data structures like stacks, queues, linked list, trees and graphs.
2. To have better insight into linear and nonlinear data structures.
3. To learn various sorting and searching techniques.
4. To exercise the applications of data structures.
5. To have a good understanding of problem solving using data structure tools and techniques.

Course Outcomes:

The student should be able to:
1. Analyze the complexities of recursive and Non recursive algorithms.
2. Apply ADT concepts such as arrays, stacks and queues for solving infix to post fix, postfix evaluation, priority queues.
3. Apply the concepts of dynamic memory allocation for reducing the time and space complexity of algorithms.
4. Implement linear, binary, interpolation, hashing searching techniques and sorting techniques namely bubble, insertion, selection, quick, merge sort.
5. Design and implement the Non linear data structures (trees and graphs) to optimize the solution.

CO-PO Mapping:

S.No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO2
CO 1	3	3	2	3	1	1	0	1	1	3	0	2	3	0
CO 2	2	2	3	2	0	0	0	1	1	2	0	2	2	0
CO 3	2	2	3	2	0	0	0	1	1	2	0	2	3	0
CO 4	2	3	3	2	0	0	0	1	1	2	0	3	2	0
CO5	2	3	3	3	0	0	0	1	1	2	0	3	3	0

COURSE CONTENTS:

UNIT I: 10- 12-Periods

Introduction: Basic Terminology, Elementary Data Organization, Data Structure operations, Fundamentals of algorithmic problem solving – important problem types –Fundamentals of analysis of algorithms and efficiency – Analysis framework – Asymptotic Notations and Basic Efficiency classes – Mathematical Analysis for recursive Algorithms and Non-recursive Algorithms, Algorithm Complexity and Time-Space trade-off.

UNIT II: 10-12 Periods

Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Sparse Matrices.

EMPLOYABILITY

Stacks: Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Applications of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of Postfix & Prefix expressions using stack, Recursion, Towers Of Hanoi Problem.

EMPLOYABILITY

UNIT III 10-12 -Periods

Queues: Array representation and implementation of queues, Operations on Queue: Insert, Delete, Full and Empty. Circular queue, De-queue, and Priority Queue, Applications of Queues.

EMPLOYABILITY

Linked list: Representation and Implementation of Singly Linked Lists, Traversing and Searching of Linked List, Insertion and deletion to/from Linked Lists, Doubly linked list, Circular Doubly linked list, Implementing priority queue using Linked List, Polynomial Representation using Linked list & addition.

EMPLOYABILITY

UNIT IV: 10-12-Periods

Trees: Basic terminology, Binary Trees, Binary tree representation, Almost Complete Binary Tree, Complete Binary Tree, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees. Binary Search Tree (BST), Insertion and Deletion in BST, AVL Trees.

EMPLOYABILITY

Searching &Sorting: Sequential search, binary search, interpolation Search, comparison and analysis, Hash Table, Hash Functions. Complexity of Search Algorithm, Insertion Sort, Bubble Sort, Selection sort, Merge Sort.

EMPLOYABILITY

UNIT V: 10-12 Periods

Graphs: Terminology & Representations- Graphs, Directed Graphs, Adjacency Matrices, Path OR Transitive Closure of a Graph, Warshall's Algorithm, Shortest path Algorithm-Dijkstra's Algorithm, Connected Component and Spanning Trees, Minimum Cost Spanning Trees, Graph Traversals.

EMPLOYABILITY

TEXT BOOKS

1. Y. Langsam, M. Augenstin and A. Tannenbaum, “Data Structures using C and C++”, Pearson Education, 2nd Edition, 1995.
2. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Pearson Education, 3rd Edition, 2012.
3. P. Padmanabham, “C Programming and Data structures”, BS publications, 3rd Edition.

REFERENCE BOOKS

1. E.Horowitz and Sahani, "Fundamentals of Data Structures"
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, Second Edition.
3. S. Lipschutz, “Data Structures”, McGraw Hill, 1986.
4. P. Dey & M. Ghosh, “Programming in C” , Oxford Univ. Press.
5. ISRD Group, “Data Structures through C++”, McGraw Hill, 2011.

CSE 214 **Object oriented Programming with JAVA** **CREDITS: 3**

INSTRUCTION: 3Theory & 1Tutorial/ Week **SESSIONAL MARKS: 40**

FINAL EXAM: 3Hrs **FINAL EXAM MARKS: 60**

Prerequisites:

Basic knowledge of computer fundamentals
Student must have knowledge of some programming languages (such as C, C++)

Course Objectives:

- To understand object oriented programming concepts, and apply them in problem solving.
- To learn the basics of java Console and GUI based programming.

Course Outcomes:

- **CO-1:** Design Classes for Real Time Applications.
- **CO-2:** Establish The Connectivity Among The Classes Using Inheritances And Interfaces.
- **CO-3:** Modularize The Application Using Packages and apply threads on classes to achieve parallelism through synchronization.
- **CO-4:** Develop Test Cases By Including The Runtime Errors Using Exceptions Handling Mechanism.
- **CO-5:** Identify AWT components to Design the GUI Using Applet & AWT Frameworks

CO-PO MAPPING:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	2	3	1	1	-	-	-	1	-	1	3	2	2
CO-2	2	3	3	2	2	-	-	-	2	-	-	3	2	2
CO-3	1	3	3	1	3	-	-	-	2	-	-	3	2	2
CO-4	1	2	3	2	2	1	-	-	2	-	-	3	2	2
CO-5	2	1	3	2	3	-	-	-	2	-	-	3	2	2

Correlation Levels 1 2 3 Defined as Below

1 High: Strong Correlation
2 Medium: Moderate Correlation
3 Low: Slight
Co1: MAPPED TO strongly mapped to Po1

COURSE CONTENTS:

UNIT-I **10-12hours**

OOP concepts - Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, Procedural and object oriented programming paradigms.

Java programming - History of Java, data types, variables, operators. Control structures, arrays, console input and output, formatting output. Simple programs on java.

Introduction to Classes, objects, constructors, methods, parameter passing, static fields and methods, access control, this reference, overloading constructors and methods, recursion, final keyword, garbage collection, finalize method, inner class and uses of inner classes, String handling.

UNIT-II **10-12 hours**

Inheritance – Basics, using super keyword, multilevel hierarchy, Member access rules, preventing inheritance- using final, the Object class and its methods.

Polymorphism - dynamic binding, method overriding, abstract class and methods.

Interfaces - Interfaces vs. Abstract class, defining an interface, implementing interfaces, accessing implementations through interface references, extending interfaces.

Packages - Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

UNIT –III **10-12 hours**

I/O: I/O basics, byte and character streams , read/ write console input/output, reading and writing files.

Exception handling – Fundamentals, Exception types, use of try and catch, throw, throws, finally, multiple catches, built-in exceptions, user defined exceptions.

Multithreading – Thread Priorities, synchronization, messaging, reading a thread, creating multiple threads, use of alive and join, inter-thread communication- suspending resuming and stopping threads, producer-consumer problem with multithreading.

UNIT-IV **10-12 hours**

Applets: Basics, Applet class, Applet Architecture, Applet skeleton. The HTML Applet tag, A simple banner applet. Difference between Application program and applet program.

AWT-Working with Windows, Graphics and Text: AWT Classes, Window fundamentals, working with Frame windows, creating a frame window in an applet. Working with graphics, working with colors, working with fonts.

UNIT-V **10-12 hours**

Event Handling: The Delegation event model, Event classes, Event Listener interfaces, handling mouse and keyboard events.

Using AWT Controls, Layout Managers and Menus: Control fundamentals, Labels, Buttons, Check Boxes, Choice Controls, Lists, Scroll bars, Text field, Text Area, Layout Managers.

TEXT BOOKS

1. Herbert Schildt, “JAVA The Complete Reference”, TataMcGraw Hill,seventh edition.
2. Y.Daniel Liang (PHI),”Introduction to JAVA PROGRAMMING”

REFERENCES BOOKS

1. P.J. Deitel and H.M. Deitel, “Java for Programmers”, Pearson education (OR) P.J. Deitel and H.M. Deitel, “Java: How to Program”, PHI.
2. P. Radha Krishna, “Object Orientd Programming through Java”, Universities Press.
3. Bruce Eckel, “Thinking in Java”, Pearson Education
4. Bruce Eckel, “Programming in Java”, Pearson Education
5. S. Malhotra and S. Choudhary, “Programming in Java”, Oxford Univ. Press.

CSE 215 PROBABILITY, STATISTICS AND QUEUING THEORY **CREDITS: 4**

INSTRUCTION: 4Theory & 1Tutorial/ Week **SESSIONAL MARKS: 40**
FINAL EXAM: 3Hrs **FINAL EXAM MARKS: 60**

Course Objective :

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Outcomes:

At the end of the course student should be able to:

CO - 1	Understand the concepts of various statistical measures like mean, variance and standard deviation of a random variable.
CO - 2	Familiarize the different types of probability distributions and their properties.
CO - 3	Compute simple correlation between the variables and fit straight line, parabola by the principle of least squares.
CO - 4	Analyze the statistical data and apply various small or large sample test for testing the hypothesis.
CO - 5	Learn about different Queuing models and its applications.

Mapping of course outcomes with program outcomes:

Course Outcomes	PO-a	PO-b	PO-c	PO-d	PO-e	PO-f	PO-g	PO-h	PO-i	PO-j	PO-k
CO - 1	3								1		3
CO - 2	3								1		3
CO - 3	3								1		3
CO - 4	3								1		3
CO - 5	3								1		3

COURSE CONTENTS:

UNIT I

Probability & Mathematical Expectations **(12 Periods)**

Introduction to probability: Definition of Random Experiment, Events and Sample space, Definition of probability, Addition and Multiplication theorems, Conditional probability, Baye's Theorem, Simple Problems on Baye's theorem. Random Variables: Discrete and Continuous random variables, Distribution function of random variable, Properties, Probability mass function, Probability density function, Mathematical expectation, Properties of Mathematical expectations, Mean and Variance.

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UNIT II

Probability Distribution **(14 Periods)**

Discrete Distributions: Binomial Distribution, Mean and Standard Deviations of Binomial Distribution, Poisson distribution, Mean and Standard Deviations of Poisson Distribution, Applications. Continuous Probability Distributions: Uniform Distribution, Exponential Distribution, Normal Distribution, Properties of Normal Distribution, Importance of Normal Distribution, Area properties of Normal curve.

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UNIT III

Curve Fitting , Correlation and Regression **(10 Periods)**

Curve Fitting : Principle of Least Squares , Method of Least Squares (Straight Line and Parabola).

Correlation : Definition, Measures of correlation, Correlation for Bivariate Distribution, Rank correlation coefficients.

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Regression : Simple linear regression, regression lines and properties.

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UNIT IV

Testing of Hypothesis **(14 Periods)**

Formulation of Null Hypothesis, Critical Region, Level of Significance.

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Small Samples : Students t - distribution (Significance test of a sample mean, Significance test of difference between sample means), F- distribution, χ^2 - test, Goodness of fit.

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Large samples : Test of Significance of Large Samples – Single Proportion, Difference between two Proportions , Single mean and Difference of means.

UNIT V

Queuing Theory **(10 Periods)**

Queue description, characteristics of a queuing model, study state solutions of M/M/1: α Model, M/M/1 ; N Model.

employability

TEXT BOOKS

1. T.Veerarajan, "Probability, Statistics and Random Processes" Tata McGraw Hill Publications.

REFERENCE BOOKS

1. Kishor S. Trivedi , "Probability & Statistics with Reliability, Queuing and Computer Applications" Prentice Hall of India ,1999 .

CSE 216 **Data Structures Lab** **Credits: 2**

Instruction: 3 Periods/week Sessional Marks: 50

End. Exam: 3 Hours End-Exam-Marks: 50

Outcomes of the Lab:

1. Be able to design and analyze the time and space efficiency of the data structure.
2. Be capable to identify the appropriate data structure for given problem.
3. Have practical knowledge on the application of data structures.
4. Able to apply different problem solving techniques on real world problems world problem.

CO-PO Mapping:

S.No	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k
CO 1	3	3	2	2	2	0	0	2	0	2	2
CO 2	2	1	2	0	3	0	2	2	2	2	2
CO 3	2	1	3	1	3	1	1	2	3	2	2
CO 4	2	3	3	0	2	0	2	3	3	2	2

List of Programs:

1) Develop C programs to implement the following using an array.
a) Stack b) Queue

2) Develop C programs to implement the following using a singly linked list.
a) Stack b) Queue

EMPLOYABILTY

3) Develop a C program to do the following
a) Infix to Postfix conversion. b) Evaluation of postfix expression.

EMPLOYABILTY

4) Develop C programs to implement the following
a) Circular Queue b) Priority Queue

5) Implement the dequeue (double ended queue) using a doubly linked list and an array.

EMPLOYABILITY

6) Write a C program to perform the following operations:
a) Insert an element into a binary search tree.
b) Delete an element from a binary search tree.
c) Search for a key element in a binary search tree.

EMPLOYABILTY

7) Write C programs that use non-recursive functions to traverse the given binary tree in
a) Pre-order b) In-order c) Post-order.

8) Write C programs for the implementation of BFS and DFS for a given graph.

EMPLOYABILTY

9) Write C programs for implementing the following sorting methods:
a) Merge sort b) Quick sort

EMPLOYABILITY

10) Write C programs for implementing the following searching methods:
a) Linear Searchb) Binary search

EMPLOYABILTY

11) Write a C program to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n.

12) Write a C program to handle the collisions using the following collision resolution Technique

a) Linear probing b) Quadratic probing c)Separate Chaining

EMPLOYABILITY

Note: All programs are to be implemented in C only TEXT BOOKS

1. Y. Langsam, M. Augenstin and A. Tannenbaum, “Data Structures using C” Pearson Education, 2nd Edition, 1995.
2. Richard F, Gilberg ,Forouzan, “Data Structures”, Cengage, 2005,2/e.

CSE 217 **Digital Electronics Lab** **Credits: 2**

(Common to CSE and IT)

Instruction: 3 Periods/week Sessional Marks: 50

End. Exam: 3 Hours End-Exam-Marks: 50

The following are the list of laboratory experiments for DIGITAL ELECTRONICS Laboratory in 2-1 (CSE & I.T Dept Autonomous) for the academic year (2016-17).

***NOTE:** FOUR Experiments from each cycle should be done compulsorily.

CYCLE-I:

Skill Development

1. Study of passive, active components & Integrated Circuits.
2. To study the regulation characteristics of given Integrated Circuits.
3. To verify the adder operation & subtractor operation using Operational amplifiers.
4. To verify the truth tables of given Logic Gates.

CYCLE-II:

Skill Development

1. Verification of truth tables of Logic gates using IC's.
2. Design a combinational circuit for Code Converters using IC's.
3. Design a combinational circuit for Adders & Subtractors (HA & FA) using IC's.
4. Design a sequential circuit for Flip-Flop and verify its characteristics using IC's..
5. Design a bidirectional Universal Shift Register Using IC74LS194.
6. Design of Counters using IC74LS73.

CYCLE-III: (Simulation using VHDL)

Skill Development

1. Write a program for verification of Basic Gates.
2. Write a program for Adder & Subtractor.
3. Write a program for Flip Flops.
4. Write a program for MUX & DEMUX.
5. Write a Program for Shift Registers.

CSE 218 **JAVA Lab** **CREDITS: 2**

INSTRUCTION: 3 Hrs/ Week **SESSIONAL MARKS: 50**
FINAL EXAM: 3Hrs **FINAL EXAM MARKS: 50**

Prerequisites:

Basic knowledge of computer fundamentals
Student must have knowledge of some programming languages (such as C ,C++)

Course Objectives:

- To understand object oriented programming concepts, and apply them in problem solving.
- To learn the basics of java Console, GUI based programming and networking programming.

COURSE OUTCOMES:

CO-1: Understanding of OOP concepts and basics of Java programming (Console and GUI based).
CO-2: The skills to apply OOP and Java programming in problem solving.

CO-3: Should have the ability to extend his/her knowledge of Java programming further on his/her own.

CO-PO MAPPING:

	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K
CO-1	3	3	3	2	2	0	2	2	2	2	2
CO-2	3	3	3	2	2	0	2	2	2	2	2
CO-3	2	2	1	3	2	0	2	3	2	2	2

.

List of Programs:

1. Write a program to find the factorial of a given number.
2. Write a program to print numbers in sorting order.
3. Create a class Odometer that displays the number of kilometers a vehicle run. Give samples as trip information like number of kilometers travelled, fuel consumption per litre. The task is to find the mileage of the vehicle running at different samples of trip information.
4. Create a class Day that represents day, month and year of the calendar day. The class Day should be able to accept the date, update the date, delete the date from a calendar list of activities. Create a class Time that represents hours, minutes, seconds of a clock. The class Time should accept the time, update the time, delete the time from a list of events created for a day using the Day Class.
5. Write a program on illustration of use of packages.
6. Write a program to implement interfaces.
7. Write a program that implements a stack ADT that converts infix expression into postfix expression
8. Write a program to read a file and displays the file on the screen within line number before each line
9. Write a program to copy contents of a file into another file using File streams.
10. Write a program for handling ArrayIndexOutofBoundsException and Divide-by-zero Exception.
11. Write a program for custom exception creation.
12. Write a program on multi-threading showing how CPU time is shared among all the threads.
13. Write a program for Producer-Consumer problem using threads.
14. Write an applet that displays a simple message.
15. Write an applet to handle the mouse events and keyboard events.
16. Write a program to develop a simple calculator. Using Grid layout arrange buttons for the digits and +,-,* % operations. The computation should be performed with a button click "Compute". Display the result on a text field.

CSE 221 **DATA COMMUNICATIONS** **CREDITS: 4**

INSTRUCTION: 4 Theory & 1Tutorial/ Week **SESSIONAL MARKS: 40**
FINAL EXAM: 3Hrs **FINAL EXAM MARKS: 60**

Prerequisite:

Basic knowledge of Computer Hardware, Network basics.

COURSE OBJECTIVES:

- To educate concepts, vocabulary and techniques currently used in the area of Data Communication, Networking and Internet.
- To interpret the Digital encoding Techniques in Data Communication.
- Familiarize the student with the basic taxonomy and terminology of the Data and signals, Signal Transmission, and Transmission Impairments.
- To accumulate existing state-of-the-art in Data Link Layer concepts and sliding window protocols and its applications.
- To analyze the functions of physical layer and gain knowledge in different mediums used for data transfer.
- Introduce the student to illustrate the point in Data Communication & networking concepts, preparing the student for that entry level courses.

Course Outcomes:

CO-1: Describe the basic data communications model, differentiate TCP/IP models and examine the transmission impairments.

CO-2: Analyze and explain the features of Transmission media, various encoding techniques.

CO-3: Apply the error correction and detection techniques.

CO-4: Analyze the performance issues of different types of LANs

CO-5: Explain the characteristics of multiplexing and spread spectrum.

CO-PO mapping

	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K	PO-L	PSO-1	PSO-2
CO-1	3	1	-	-	-	1	1	-	-	-	1	1	-	-
CO-2	3	2	2	-	1	-	1	-	-	-	1	1	-	-
CO-3	3	2	3	2	1	-	-	-	-	-	-	-	-	-
CO-4	1	3	1	1	1	-	-	-	-	-	-	-	-	-
CO-5	2	2	2	1	1	-	-	-	-	-	-	-	-	-

EMPLOYABILITY

UNIT 1:

Data Communications, Data Networking, Internet: A Communications Model, Data Communications, Networks, The Internet, An Example Configuration, Protocol Architecture. The Need for a Protocol Architecture: The TCP/IP Protocol Architecture, The OSI Model, Traditional Internet-Based Applications,Characteristics of Data,Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments.

EMPLOYABILITY

UNIT 2:

Transmission Media:

Guided Transmission Media, Wireless Transmission Data Encoding, Digital Data, Digital Signals, Analog Signals, Analog.

UNIT 3:

The Digital Data Communication Techniques:

Asynchronous and Synchronous Transmission, Line Configurations, Interfacing.Data Link Control Flow Control, Types of Errors, Error Detection, Error Control, High-Level Data Link Control (HDLC).

EMPLOYABILITY

UNIT 4:

Local Area Network:

Overview, LAN Protocol Architecture, Bridges, Layer 2 and Layer 3 Switches. High-Speed LANs: The Emergence of High-Speed LANs,Wireless LANs:Overview,Wireless LAN Technology,IEEE 802.11 Architecture and Services.

UNIT 5:

Modems and Modem Circuits. Multiplexing: Frequency-Division Multiplexing, Synchronous Time-Division Multiplexing: Characteristics, TDM Link Control, Digital Carrier Systems Statistical Time-Division Multiplexing: Characteristics, The Concept of Spread Spectrum,Frequency Hopping Spread Spectrum,Direct Sequence Spread Spectrum,Code-Division Multiple Access.

EMPLOYABILITY

TEXT BOOKS

William Stallings, “Data and Computer Communications” , Pearson Education Inc., 2010 8th Edition.

REFERENCE BOOKS

Behrouz A. Forouzan, “Data Communications and Networking”, TMH, 2004, 3rd Edition.

CSE 222 MICROPROCESSOR AND INTERFACING CREDITS: 3
INSTRUCTION: 3Theory & 1Tutorial/ Week SESSIONAL MARKS: 40
FINAL EXAM: 3Hrs FINAL EXAM MARKS:60

PREREQUISITE: Digital Logic

Course Objectives:

1. The objective of this course is to become familiar with the architecture and the instruction set of an Intel microprocessor.
2. Assembly language programming will be studied as well as the design of various types of digital and analog interfaces
3. To provide solid foundation on interfacing the external devices to the processor according to the user requirements to create novel products and solutions for the real time problems.
4. To assist the students with an academic environment aware of excellence guidelines and lifelong learning needed for a successful professional career.
5. The accompanying lab is designed to provide practical hands-on experience with microprocessor software applications and interfacing techniques

Course Outcomes:

CO	Description
CO-1	To interpret the concepts of internal operations of the computer and the working principles of Microprocessor.
CO-2	To understand the architecture, pin configuration of 8085 Microprocessors along with the programming knowledge for practical implementation of assemble level programming using instruction set of 8085
CO-3	To demonstrate the significance of Addressing modes and the timing diagrams to analyse the working of the microprocessor.
CO-4	Experimenting the interfacing of the 8085 microprocessor with co-processors and External I/O devices.
CO-5	To analyse the internal architecture and pin configuration of 8086 MicroProcessor along with the programming knowledge for practical implementation of assemble level programming using instruction set of 8085

CO-PO Matrix

	PO A	PO B	PO C	PO D	PO E	PO F	PO G	PO H	PO I	PO J	PO K	PO L	PSO 1	PSO 2
CO 1	3	1							3	1			2	2
CO 2	3	3	2	2					1	1				1
CO 3	2	2	1		2									
CO 4	2	1	1		2									
CO 5	3	3	2	2					1	1				1

UNIT I

The 8085A µP. Architecture and Instruction Set:

Introduction to Microprocessors and Microcomputers, Internal Architecture and Functional/Signal Description of typical 8-bit µP.- 8085, Instruction Set and Timing Diagrams of 8085 µP. Interfacing SRAMs, and EPROMs to 8085.

15 h

UNIT II

Programming the 8085 µP.:

Assembly Language Programming Requirements, Programming Techniques: Looping, Counting, and Indexing, Counter and timing Delays, Stack and Subroutines, Code Conversion, BCD Arithmetic, 16-bit data Operations, Interrupts and Interrupt Service Routines

10h

Skill Development

UNIT III

Interfacing Peripheral ICs to Intel 8085

Parallel I/O Interface - 8255, Serial I/O Interface – 8251, Timer Interface - 8253, Keyboard/Display Interface - 8279, Interrupt Controller Interface - 8259, D/A Conversion Methods, A/D Conversion methods, Interfacing DAC, Interfacing ADC.

Skill Development

20h

UNIT IV

The 8086 µP. Architecture and.:

Internal Architecture and Functional/Signal Description of 8086/8088 Segmented Memory, Maximum-Mode and Minimum-Mode Operation, Addressing Modes.

Skill Development

10h

UNIT V

Programming the 8086 µP

Instruction Set and Timing Diagrams Assembly Language Requirements, Data Definition, Loops, Procedures, Modular programming, and Macros

Skill Development

5h

TEXT BOOKS:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085" Penram International ,6th Edition,
2. John E.Uffenbeck, "The 80x86 Family, Design, Programming and Interfacing3rdEdition, Pearson Education Inc.", 2002

REFERENCE BOOKS:

1. BARRY B. BREY, "The Intel Microprocessors 8086/8088, 80186/80188,80286,80386 and 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and Interfacing", Pearson Education Inc., 2003,6thEdition.
2 Walter A. Tribel and Avtar Singh," The 8088 and 8086 Microprocessors, Programming, interfacing, Software, Hardware, and Applications", Pearson Education Inc., 2003,4thEdition.
3. Douglass V. Hall,"Microprocessors and Interfacing, Programming and Hardware" , TMH Edition, 1999, 2ndEdition
4. Sanjay K Bose, "Hardware and Software of Personal Computers", New Age International (P) Ltd., 1991

CSE 223 **OPERATING SYSTEMS** **CREDITS: 4**

INSTRUCTION: 4Theory & 1Tutorial/ Week **SESSIONAL MARKS: 40**
FINAL EXAM: 3Hrs **FINAL EXAM MARKS: 60**

Course Objectives:

1. Introduce various fundamental concepts and principles of operating systems .
2. This course provides a comprehensive introduction to understand the underlying techniques and approaches which constitute a coherent body of knowledge in operating systems. In particular, the course will consider inherent functionality and processing of program execution .
3. The emphasis of the course will be placed on understanding how the various elements that underlie operating system interact and provides services for execution of application software

Course Outcomes:

1. Illustrate the structure of OS, Functionality and services provided by the OS.Analyse the concept of process state and state transitions.
2. Implement the CPU Scheduling algorithms (FCFS, SJF, PRORITY and ROUND ROBIN).Demonstrate the concept of Process synchronization and resource allocation.
3. Apply and analyze the memory management mechanism (virtual memory, demand paging and page replacement).
4. Demonstrate the structure and organization of file systems and analyze the implementation of file systems.
5. Analyze the disk structure, disk scheduling, management and protection issues.

Mapping of COs and POs

Mapping		**PO**												**PSO**	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	1	1					1	1	2		1		
	2	2	3	1	1		1	1	1	2	2	1	1	1	
	3	2	3	1	1		1	1	1	2	2	1	1	1	
	4	1	2	1					1	1	2		1	1	
	5	1	2	1			1	1	1	1	2		1		

COURSE CONTENTS:

UNIT I

Introduction to OS

Introduction to operating systems – review of computer organization – operating system structures – system calls – system programs – system structure – virtual machines. **Process Management**

EMPLOYABILITY

EMPLOYABILITY

Processes: Process concept – Process scheduling – Operations on processes –Cooperating processes – Interprocess communication. Multi threaded programming. Communication in client-server systems. Multi-Threaded Programming:Overview; Multithreading models; Thread Libraries; Threading issues.

EMPLOYABILITY

EMPLOYABILITY

UNIT II

Process Scheduling and Synchronization

CPU Scheduling: Scheduling criteria – Scheduling algorithms – Multiple-processorscheduling – Real time scheduling – Algorithm Evaluation. Process Synchronization: The critical-section problem –Synchronization hardware – Semaphores – Classic problems of synchronization – critical regions – Monitors. Deadlock: System model – Deadlock characterization –Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance, Deadlock detection – Recovery from deadlock.

EMPLOYABILITY

EMPLOYABILITY

EMPLOYABILITY

EMPLOYABILITY

EMPLOYABILITY

EMPLOYABILITY

UNIT III

Memory Management

Memory Management: Background – Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging. Virtual Memory: Background – Demand paging – Process creation – Page replacement – Allocation of frames – Thrashing.

EMPLOYABILITY

UNIT IV

File Systems and its Implementation

File-System Interface: File concept – Access methods – Directory structure – Filesystem mounting – Protection. File-System Implementation : Directory implementation – Allocation methods – Free-space management – efficiency and performance – recovery – log-structured file systems.

UNIT V

Secondary Storage Structures and Protection

Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems.

Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory management; File systems, Input and output; Inter-process communication

TEXT BOOKS

1. Silberschatz, Galvin, and Gagne, “Operating System Concepts”, Wiley India Pvt Ltd, 2003, Sixth Edition.

REFERENCES

1. Andrew S. Tanenbaum, “Modern Operating Systems”, Pearson Education, 2004, Second Edition.
2. Gary Nutt, “Operating Systems”, Pearson Education, 2004 ,Third Edition.
3. Harvey M. Deitel, “Operating Systems”, Pearson Education, 2004, Third Edition.

CSE 224 COMPUTER ORGANIZATION CREDITS: 4

INSTRUCTION: 4Theory & 1Tutorial/ Week SESSIONAL MARKS: 40
FINAL EXAM: 3Hrs FINAL EXAM MARKS: 60

PREREQUISITE:

Digital Logic COURSE

OBJECTIVE:

- To understand the basics of computer hardware and how software interacts with computer hardware.
- To understand the structure, function and characteristics of computer systems.
- To understand the basic structure and operation of digital computer.
- To study the design of arithmetic and logic unit.
- To study the two types of control unit techniques and the concept of pipelining.
- To understand the hierarchical memory system including cache memories and virtual memory.
- To understand the different ways of communicating with I/O devices and standard I/O interfaces.

COURSE OUTCOMES:

Student will be able to :

CO1: Identify the basic principles and apply to arithmetic for ALU implementation. (Remember& Apply – L1&L3)
CO2: Examine the functional aspects of processor unit. (Analyse – L4)
CO3: Compare and assess the working principles of hardwired and microprogrammed control unit (Understand &Evaluate – L2 & L5)
CO4: Inspect addressing modes, instruction formats in various CPU organizations and Assess the performance implications of processing techniques. (Analyse – L4)
CO5: Infer the design issues in memory and I/O organizations. (Evaluate- L5)

CO-PO MAPPING:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	2	2	1					1	1		1	1	1
CO-2	2	2	2	1									1	2
CO-3	1	3	2	3									1	1
CO-4	2	2	2	2									1	2
CO-5	2	3	3	3					1	1		1	2	2

COURSE CONTENTS:

UNIT-1

Register Transfer and Micro operations :

Register Transfer Language, Bus and Memory Transfers, Arithmetic, Logic and Shift Micro operations, Arithmetic Logic Shift Unit,

Computer Arithmetic:

Introduction, Addition and Subtraction, Booth Multiplication Algorithm, Decimal Arithmetic Unit.

Skill Development

UNIT-2

Basic Computer Organization:

Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Complete Computer Description.

UNIT-3

Control Design:

Hardwired & Micro Programmed (Control Unit), Control Memory, Address Sequencing, Conditional and Unconditional Branching, Micro program Example.

Employability & Skill Development

UNIT-4

Central Processing Unit:

Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes with numerical examples, Data Transfer and Manipulation, Program Control, Program Interrupt, Types of interrupts, CISC Characteristics, RISC Characteristics.
Introduction to Parallel Processing, Pipelining – General Considerations.

Employability & Skill Development

UNIT-5

Input-Output Organization:

Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access.

Employability & Skill Development

Memory Organization:

Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Employability & Skill Development

TEXT BOOKS

1. M.Morris Mano, “Computer System Architecture”, Pearson Education Inc., 2003, Third Edition,.

REFERENCE BOOKS

1. John D. “Carpinelli ,Computer Systems Organization and Architecture”, Pearson Education Inc., 2003.

CSE 225 FORMAL LANGUAGES AND AUTOMATA THEORY CREDITS: 4

INSTRUCTION: 4Theory & 1Tutorial/ Week SESSIONAL MARKS: 40
FINAL EXAM: 3Hrs FINAL EXAM MARKS: 60

Course Objectives:

- Introduce concepts in automata theory and theory of computation
- Identify different formal language classes and their relationships
- Design grammars and recognizers for different formal languages
- Prove or disprove theorems in automata theory using its properties
- Determine the decidability of computational problems.

Course Outcomes:

1. Analyze the finite automata and regular expressions for accepting the language.
2. Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.
3. Construct algorithms for different problems and correctness on different restricted machine models of computation (Context free grammar).
4. Construct a Pushdown automata for languages acceptance of a PDA and pumping lemma for CFGs
5. Construct the Turing machine for accepting unrestricted grammar and determine the decidability of computational problems.

Mapping of COs and Pos

Mapping		**PO**												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3	2	2	2	0	0	0	1	1	1	1	1	0
	2	2	2	2	2	2	0	0	0	1	1	1	1	1	0
	3	2	2	3	2	2	0	0	0	1	1	1	1	1	0
	4	2	2	3	2	3	0	0	0	1	1	1	1	1	0
	5	2	2	3	2	3	0	0	0	2	1	1	2	1	0

COURSE CONTENTS:

UNIT -1

Introduction to Finite Automata: Introduction to Finite Automata; The Central concepts of Automata theory; Deterministic finite automata;Nondeterministic finite automata.
Finite Automata, Regular Expressions: An application of finite automata ;Finite automata with Epsilon-transitions; Regular expressions; FiniteAutomata and Regular Expressions; Applications of Regular Expressions. Two way finite automata, finite automata with output**:** Mealy and Moore machines.

UNIT -2

Regular Languages, Properties of Regular Languages: Regular languages; Proving languages not to be regular languages; Closure propertiesof regular languages; Decision properties of regular languages; Equivalence and minimization of automata. Pumping lemma, closure properties, decision algorithm, MyHill- Nerode theorem and minimization of finite automata.

UNIT -3

Context-Free Grammars And Languages : Context –free grammars; Parse trees; Applications; Ambiguity in grammars and Languages

UNIT -4

Pushdown Automata: Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG's; Deterministic PushdownAutomata.
Properties of Context-Free Languages: Normal forms for CFGs; The pumping lemma for CFGs; **Closure properties of CFLs**

UNIT -5

Introduction To Turing Machine: Problems that Computers cannot solve;The turing machine; Programming techniques for Turning Machines;Extensions to the basic Turing Machines; Turing Machine and Computers.church's hypothesis. The classes P and NP; NP-Completeness; Satisfiability and Cook's theorem; Polynomial reduction and some NP-complete problems.
Undecidability: properties of recursive and recursively enumerable languages, universal Turing machines, Rice's theorem, Post Correspondence Problem, Greibach's theorem, introduction to recursive function theory, Oracle computation; Chomsky Hierarchy**:** regular grammars, unrestricted grammars, context sensitive languages, relations between classes of languages.

TEXT BOOKS

1.John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: “Introduction to Automata Theory, Languages and Computation”, Pearson Education, 2007,3rd Edition.

REFERENCE BOOKS

1. Mishra &Chandrasekharan, “Theory of computer science: Automata language and computation”, Prentice Hall of India, 3rd Ed,2007.

2. K.L.P. Mishra: “Theory of Computer Science, Automata, Languages, and Computation”, PHI Learning, 2009,3rd Edition.

3. John C Martin: “Introduction to Languages and Automata Theory”, Tata McGraw-Hill, 2007 3rd Edition.

4. P. Linz, “Introduction to Formal Language and Computation”, Narosa, 2nd Ed, 2006.

CSE 226 MICROPROCESSOR AND INTERFACING LAB CREDITS: 2
INSTRUCTION: 3Periods/ Week SESSIONAL MARKS: 50
FINAL EXAM: 3Hrs FINAL EXAM MARKS: 50

Course Objectives:

1. Developing of assembly level programs and providing the basics of the processors
2. To provide solid foundation on interfacing the external devices to the processor according to the user requirements to create novel products and solutions for the real time problems
3. To assist the students with an academic environment aware of excellence guidelines and lifelong learning needed for a successful professional career

Course Outcomes:

CO-1:Able to understand the problem and interfacing of peripheral devices through ALP programming .
CO-2: The students will learn how to design, build, and debug simple microcontroller based systems.
CO-3:To be able to test a solution for different parameters and cases and analyze the solution
CO-4:The students will work in groups of 2 to 4 and thereby learn how to cooperate in teams.

CO-PO Mapping

	PO-a	PO-b	PO-c	PO-d	PO-e	PO-f	PO-g	PO-h	PO-i	PO-j	PO-k
CO-1	0	2	3	0	1	0	0	2	1	3	2
CO-2	0	3	3	0	1	0	0	2	1	3	2
CO-3	1	3	0	0	1	0	0	2	1	3	2
CO-4	0	0	0	3	1	0	0	2	0	0	0

Assembly Language Programming :

1. 8085 Assembly Language Programming according to theory course using the following trainers :
Keyboard Monitor of 8085µP Trainer.

3 Weeks

2.INTERFACING WITH 8085 TRAINER

2.1.8255 study card for mode 0,1 practice.
HEX KEYBOARD AND DOT MATRIX HEX LED DISPLAY INTERFACE
8279-PROGRAMMABLE KEYBOARD/DISPLAY INTERFACE

Skill Development

3 weeks

3.INTERFACING WITH PC

STEPPER MOTOR CONTROLLER
DAC/ADC INTERFACE
8253 TIMER INTERFACE
TRAFFIC LIGHT CONTROLLER INTERFACE

Skill Development

5 weeks

4. 8086 Assembly Language Programming according to theory course using the following :

PC Assembler using TASM or MASM, TD or SYMDEB or CVD(Code View debugger). 2 weeks

Skill Development

CSE 227 **Operating Systems Laboratory** **CREDITS: 2**

INSTRUCTION: 3Periods/ Week **SESSIONAL MARKS: 50**
FINAL EXAM: 3Hrs **FINAL EXAM MARKS: 50**

PREREQUISITE: C Programming

COURSE OBJECTIVE:

1. To understand and write program in Unix environment
2. To design and implement the scheduling algorithms
3. To design and implement advanced file system operations

COURSE OUTCOMES:

CO1: Implement the system calls to communicate with system programming

CO2: Implement the Unix commands and Shell programming

CO3:Implement the process management, page replacement, memory and resource allocation algorithm

Mapping of COs and POs

Mapping		**PO**												**PSO**	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	1	2			1	1	1	2	2		1	1	
	2	1	2	3			1	1	1	2	2		1	2	
	3	2	3	3	2		1	1	1	2	2	1	1	2	

LIST OF SAMPLE PROGRAMS

Write a C program for the following

1. Study of laboratory environment:Hardware specifications, software specifications
2. Simple Unix-C programs:Programs using system calls, library function calls to display and write strings on standard output device and files.
3. Programs using fork system calls.
4. Programs for error reporting using errno, perror( ) other system functions.
5. Programs using pipes. EMPLOYABILITY
6. Shell programming.Simple logic programs
7. C Programs to implement the shell commands
8. Programs to simulate process scheduling like FCFS, Shortest Job First and Round Robin.
9. Programs to simulate page replacement algorithms like FIFO, Optimal and LRU. EMPLOYA
10. Programs to simulate free space management.
11. Programs to simulate virtual memory. EMPLOYABILITY
12. Program on deadlock management.
13. Programs to simulate deadlock detection. EMPLOYABILITY

REFERENCE BOOKS

1. Sumitabha Das, “Unix concepts and applications” ,TMH Publications.
2. Stevens, “Unix programming” , Pearson Education.
3. Yashwanth Kanetkar ,“Shell programming” .
4. Silberschatz, and Peter Galvin ,“Operating System Concepts” .

CSE 228 **Hardware Lab** **CREDITS: 2**

INSTRUCTION: 3Periods/ Week **SESSIONAL MARKS: 50**
FINAL EXAM: 3Hrs **FINAL EXAM MARKS: 50**

Prerequisite

Minimum computer hardware knowledge

Course Objectives:

1. To understand the need of PC hardware
2. To be able to install different operating systems
3. To be able to troubleshoot hardware problems
4. To be able to troubleshoot software problems

Course Outcomes:

1. Understanding of different computer peripherals and interfaces
2. Describe the architecture of various computer hardware devices and their functioning
3. Configure and install the different operating systems

	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO- I	PO-J	PO-K
CO-1	0	2	0	0	0	0	2	2	1	3	2
CO-2	1	2	1	3	1	0	2	3	1	0	0
CO-3	1	3	1	0	2	0	3	2	1	0	1

Week 1 & 2

The Instructor should explain the students about the PC Hardware like Motherboard, Processor, RAM, Hard Disk, Network Interface Card and other peripheral devices.

Skill set

Week 2 & 3

Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Week 4 & 5

Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva.

Employability

Week 6 & 7

Every student should individually install operating system (Windows) in the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Employability

Week 8 & 9

Every Student should individually install Operating system (Linux – Ubuntu) in the personal computer. Lab instructor should verify the installation and follow it.

Employability

Week 10 & 11

Every Student should individually install Operating system (Linux – Ubuntu) and Windows as **Dual Boot** in the personal computer. Lab instructor should verify the installation and follow it.

Employability

Week 12 & 13

Hardware Troubleshooting

Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

Week 14 & 15

Software Troubleshooting

Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

TEXT BOOKS

1. Peter Norton ,"Peter Norton's Inside the PC",. –, SAMS publications Eight Edition
2. Kate J. Chase ,"PC Hardware and A+ Handbook" , PHI (Microsoft)
3. Vikas Gupta, "Comdex Information Technology course tool kit" WILEY Dreamtech
4. Cheryl A Schmidt, "The Complete Computer upgrade and repair book", WILEY Dreamtech 3rd edition

FILE SYSTEMS & DATABASES	
CSE 311(A)	**Credits : 3**
Instruction **:** 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

1. Basic knowledge of Computer Fundamentals.
2. Contexts in which databases are used

Course Objectives:

1. Analyze the theory behind various database models and query languages
2. Apply querying languages, primarily SQL, and other database supporting software
3. Analyze Transaction management and Concurrency Control
4. Design and implement database projects

Course Outcomes:

1. CO-1: able to differentiate the architecture of file systems and Databases and interpret them.
2. CO-2: able to design E-R Diagrams and Relational Model.
3. CO-3: able to analyze and practice Query Processing
4. CO-4: able to analyze and apply Normalization technics.
5. CO-5: able to observe Transaction Processing, Concurrency Control.

CO-PO MAPPING:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	1												3
	2		3	3	2					3				3	3
	3		1	3	2	2				3				3	3
	4		3	3	3	2				3				3	3
	5		3		3									3	3

Course Content:

UNIT-I **12 Periods**

Overview of File Structures:

File System :

File Concept, Access methods, Protection.

EMPLOYABILITY

Storing Data-Disks and Files:

The Memory Hierarchy-Magnetic Disks-performance implications of disk architecture-Redundant arrays of independent disks-data sharing-redundancy-levels of redundancy-disk space management-buffer management-files of records-page formats-record formats.

EMPLOYABILITY

EMPLOYABILITY

EMPLOYABILITY

UNIT-II **10 Periods**

Overview of Database Management:

File Systems vs DBMS, Introduction& Advantages of DBMS - What is database system – What is database - Why is database – Data Dependency

EMPLOYABILITY

Database System Architecture:

EMPLOYABILITY

Introduction – Three levels of architecture – The External level, The Conceptual level, The Internal level, Mappings, The database administrators, The database Management Systems, Client/Server Architecture, Distributed Processing.

EMPLOYABILITY

UNIT –III **10 Periods**

Introduction to Database Design

Database design and ER Diagram – Entities, Attribute, and Entity Set – Relationships and Relationship Set – Additional Features of ER Model

EMPLOYABILITY

An Introduction to Relational Model:

Introduction – An Informal Look at the Relational Model – The Catlog – Base Tables and Views – Transaction

EMPLOYABILITY

EMPLOYABILITY

Relations:

Introduction – Tuples – Relation Types – Relational Values - Relation Variables

EMPLOYABILITY

UNIT-IV **10 Periods**

SQL: Overview –

UNION, INTERSECTION and EXCEPT – Nested Queries – Aggregation Operators – Null Values – Triggers and Active Databases –PL-SQL – Embedded SQL

EMPLOYABILITY

EMPLOYABILITY

UNIT-V **8 Periods**

Schema refinement and normal forms :

Schema refinement, functional dependencies, reasoning normal forms, normalization up to 3rd & BC normal forms, lossless join & dependency preserving decomposition

EMPLOYABILITY

Transaction management:

Transaction concept, transactions and schedules, concurrent execution of transactions, lock – based concurrency control

EMPLOYABILITY

TEXT BOOKS:

1.Avi Silberschatz,Peter Baer Galvin and Greg Gagne "*Operating System Concepts*" , Eighth Edition,wiley Publications (Only for Unit – I)

2.C.J.Date "*An Introduction to Database Systems*", Eighth Edition – (Only for Unit – II)

3. Raghu RamaKrishna and Gehrke , "*Database Management Systems*", McGraw - Hill

OPEN ELECTIVE – I (for Non-CSE Students)

COMPUTER OPERATING SYSTEMS	
CSE 311(B)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

To undertake this course student must have good foundation of Computer Basics.
Student must be familiar with concepts of microprocessor and computer organization.
Prior programming experience with C (or any other programming language) is recommended.

Course Objectives:

- Students should able to understand the importance and need of operating systems.
- Students should learn the inter process communication, resource allocation and deadlock management.
- To understand the concept of memory management.
- To make the students aware of the File systems and input/output management.
- Student must know the different operating systems available and how do they function.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Be familiar with basics like need, functions, Challenges of Operating System and
2.	Analyze the theory and logic behind inter process communication, Synchronization and deadlock handling.
3.	Describe and differentiate various memory management techniques.
4.	Recognize and use file system interface, protection and security mechanism disk management and disk scheduling algorithms for better utilization of memory.
5.	Compare various features like scheduling, memory management etc of different Operating systems.

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12		
CO	1	1	1		1	1				1	2	1	2		
	2	2	3		2	2				2	2	2	2		
	3	2	3		2	2				2	2	2	2		
	4	2	3		2	2				2	2	2	2		
	5	2	3		3	3				2	2	2	2		

SYLLABUS

UNIT-I: **15 Periods**

Introduction to OS:

What is OS? History of Operating Systems, Operating System Concepts, Operating Systems Structure, Functions & need of Operating Systems.

Process Management:

Introduction to Processes, process control block, process state diagram. Scheduling algorithm, Threads and multithreading.

UNIT-II: **15 Periods**

Process coordination:

Inter Process Communication, Classical IPC Problems: Dining philosopher problem, producer consumer problem, read & write problem.

Deadlocks:

Resources, Deadlocks, the Optical Algorithm, Deadlock Detection and Recovery, Deadlock Avoidance, Deadlock Prevention.

UNIT-III **15 Periods**

Memory Management:

Memory Management without Swapping or Paging, Swapping, Memory allocation and free space memory management algorithms.

Virtual Memory Management:

Virtual Memory, Page Replacement Algorithms, Modeling Paging Algorithms, Design issues for paging systems, Segmentation.

UNIT-IV: **15 Periods**

File Systems and Input/output:

Files, Directories, Security, Protection mechanism, Principles of I/O Software &Hardware, Disk Structure, Disk Scheduling algorithm.

UNIT-V: **15 Periods**

RTOS, DOS, Mobile OS – Introduction, Overview of Windows Operating Systems Scheduling, Linux Scheduling. Synchronization in Windows Operating Systems, Linux. Memory Management in Windows Operating Systems and Linux.

Text Books:

1. Andrew S. Tanenbaum "Modern Operating Systems "4th Edition, Pearson

Reference Books :

1. Avi Silberschatz,Peter Galvin,Grey Gagne *"Applied Operating Systems Concepts",* 5th edition John Wiley & Sons;

Web Resources:

1.http://nptel.ac.in/courses/106108101/
2.https://onlinecourses.nptel.ac.in/noc16_cs10/preview
3.https://www.coursera.org/learn/iot/lecture/MrgxS/lecture-3-1-operating-systems

OPEN ELECTIVE – I (for Non-CSE Students)

FUNDAMENTALS OF COMPUTER NETWORKS	
CSE 311(C)	**Credits : 3**
Instruction **:** 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Basic knowledge of data structure and operating system.

Course Objectives:

- To understand the fundamental concepts of computer network and data communication.
- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Analyzing the basics fundamental of Data Communications and Computer Networks protocols.
2.	Enumerate the layers of the OSI model and TCP/IP
3.	Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols.
4.	Should have the ability to administrate a network and analyze the flow of information in computer network.
5.	Identify the different types of network devices and their functions within a network.

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	2	2	3							1	3	3
	2	3	2	2	2	2							2	2	2
	3	3	3	3	2	3							1	2	2
	4	3	3	3	2	3							2	2	2
	5	3	3	2	1	3					1		2	2	2

SYLLABUS

EMPLOYABILITY

UNIT-I: **12 Periods**

Understanding of network and Internet:

Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards and administration; Comparison of the OSI and TCP/IP reference model.

Physical Layer:

Guided transmission media, wireless transmission media.

EMPLOYABILITY

Data Link Layer

Design issues, CRC codes, Elementary Data Link Layer Protocols, sliding window protocol.

UNIT-II: **12 Periods**

Multi Access Protocols:

ALOHA, CSMA, Collision free protocols, Ethernet- Physical Layer, Ethernet Mac Sub layer, data link layer switching & use of bridges, learning bridges, spanning tree bridges, repeaters, hubs, bridges, switches, routers and gateways.

EMPLOYABILITY

UNIT-III: **12 Periods**

Network Layer:

Network Layer Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Control to Infinity Problem, Hierarchical Routing, Congestion control algorithms.

EMPLOYABILITY

UNIT-IV: **12 Periods**

Internetworking:

Tunneling, Internetwork Routing, Packet fragmentation, IPv4, IPv6 Protocol, IP addresses, CIDR, IMCP, ARP, RARP, DHCP.

Transport Layer:

Introduction and transport layer services, Multiplexing and Demultiplexing, Connection less transport (UDP), Principles of reliable data transfer, Connection oriented transport (TCP).

EMPLOYABILITY

UNIT-V: **12 Periods**

Application Layer:

Principles of computer applications, Introduction, providing services, Applications layer paradigms, Client server model, standard client-server application, FTP, electronic mail, TELNET, DNS, Web and HTTP.

Text Books:

1. Behrouz A. Forouzan,*"Data Communications and Networking"*
2. Behrouz Forouzan ,"*TCP/IP Protocol Suite*", 3rd edition, McGraw Hill

Reference Books :

1. Andrew Tanenbaum ,"*Computer Networks*",4th edition,Prentice Hall
2. Behrouz Forouzan,"*Computer Networks- A Top-Down approach"*, McGraw Hill
3. William Stallings,"*Data and computer communication*", Eigth edition. Pearson
4. Kurose and Ross," *Computer Networking- A Top-Down approach*", 5th edition, Pearson

Web Resources:

http://nptel.ac.in/courses/106105082/

DATABASE MANAGEMENT SYSTEMS	
CSE 312	**Credits : 4**
Instruction **:** 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Elementary knowledge about computers including some experience using UNIX or Windows.Knowledge about data structures and algorithms, corresponding to the basic course on Data Structures and Algorithms.

Course Objectives:

- Understand basic database concepts, including the structure and operation of the relational data model.
- Understand logical database design principles, including E-R diagrams and database normalization.
- To learn the basics of SQL and construct queries using SQL.
- Understand the concept of database transaction and concurrency control,backup and recovery,data object locking and protocols.

Course Outcomes:

Students will be able to :

CO-1: Interpret the basic concepts of Database Management Systems, Transaction Management and Architecture of DBMS

CO-2: Apply the principles of ER Model and Relational Model in Conceptual and Logical Database Design.

CO-3: Construct and evaluate SQL Queries and Relational Algebra, Relational Calculus expressions.

CO-4: Apply the principles of normalization in schema refinement.

CO-5: Investigate different transaction management and recovery techniques

Mapping of Course Outcomes with Program Outcomes:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	1	1	1	1	1	0	0	0	1	0	0	1	1	1
CO-2	1	2	2	1	1	0	0	1	1	0	0	1	2	1
CO-3	2	3	3	1	2	1	0	1	1	1	1	1	2	2
CO-4	2	2	3	2	1	1	0	1	1	1	1	1	2	2
CO-5	2	2	3	2	1	1	0	1	1	1	1	1	2	2

1-low,2-Medium 3-strong

SYLLABUS

UNIT-I: **12 Periods**

Introduction to DBMS:

Overview of DBMS, File system versus a DBMS , Advantages of a DBMS, Three Schema architecture of DBMS, Data Models, Database Languages, Transaction Management , Structure of a DBMS ,Client/Server Architecture ,Database Administrator and Users.

Entity-Relationship Model:

Design Issues, ER Modeling concepts , Cardinality constraints, Weak-entity types, Subclasses and inheritance, Specialization and Generalization, Conceptual Database Design With the ER Model.

UNIT-II: **10 Periods**

Relational Model:

Structure of Relational Databases, Basics of Relational Model ,Integrity Constraints, Logical Database Design, Introduction to Views, Destroying/ Altering Tables and Views, Relational Algebra, Relational Calculus.

UNIT-III: **12 Periods**

SQL:

Concept of DDL, DML, DCL, Set operations, Nested queries ,Aggregate Functions, Null Values, Referential Integrity Constraints, assertions, views, EmbeddedSQL ,Cursors Stored procedures and triggers,ODBC andJDBC, Triggers andActive Database, designing active databases.

UNIT-IV: **12 Periods**

Database Design:

Schema Refinement,Functional Dependencies,Reasoningabout Functional Dependencies, Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF.

Security:

Access Control,DiscretionaryAccess Control - Grant and Revoke on Views and Integrity Constraints, Mandatory Access Control.

UNIT-V: **15 Periods**

Transaction Management:

The ACID Properties,Transactions & Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control.

Concurrency Control:

2PL,Serializability and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Deadlocks, Specialized Locking Techniques, Concurrency Control without Locking.

Crash Recovery:

Introduction to ARIES, The Log, Other Recovery-Related Structures, The Write-Ahead Log Protocol, Check pointing, Recovering from a System Crash, Media Recovery.

Text Books:

1. Raghu Ramakrishnan, Johannes *Gehrke "Database Management Systems"*, 3rd Edition, McGraw- Hill

References Books:

1. A.Silberschatz.H.Korth, *"Database System Concepts"* , 5th Edition, McGraw-Hill

Web Resources:

1. https://www.youtube.com/playlist?list=PLyvBGMFYV3auVdxQ1-88ivNFpmUEy- U3M
2. http://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design/pdf/1_Introduction.pdf
3. https://www.youtube.com/watch?v=1057YmExS-I

COMPUTER GRAPHICS	
CSE 313	**Credits : 4**
Instruction **:** 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Elementary knowledge in C programming, solving mathematical expressions.

Course Objectives:

During the course, the student will be able to

1. Explain applications in the real world and the graphics systems used in developing graphics.
2. Design basic primitives (both 2D and 3D) using algorithms.
3. Apply transformations on the objects.

Course Outcomes

By the end of the course, the student will be able to:

1. Explain computer graphics, applications and contemporary terminology, hardware components etc.
2. Design 2D and 3D objects using algorithms and apply attributes of primitives, anti -aliasing.
3. Apply geometric transformations on 2D and 3D objects.
4. Apply viewing transformations on 2D and 3D objects
5. Explain visible surface methods

Articulation Matrix

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2											1		
CO2	1	2	3	1	2				2	1	2	3		2
CO3	2	2	2	1	2				2	1	2	3		2
CO4	2	2	2	1	2				2	1	2	3		2
CO5	1	2	2	1	2				2	1	2	3		2

SYLLABUS

UNIT-I: **8 Periods**

Introduction:

Applications:

Usage of Graphics and their applications, Presentation Graphics- Computer Aided Design- Computer Art- Entertainment- Education and Training- Visualization- Image Processing- Graphical User Interfaces.

Overview of Graphics Systems:

Video Display Devices - Raster Scan systems - Random Scan Systems - Graphics Monitors and Workstations - Input devices - Hard Copy Devices- Graphics Software.

UNIT-II: **12 Periods**

Output Primitives & its Attributes:

Points and Lines-Line Drawing Algorithms- Loading the Frame buffer- Line function- Circle-Generating Algorithms- Ellipse Generating Algorithms- Filled Area Primitives-Filled Area Functions- Cell Array- Character Generation.

Attributes of Output Primitives:

Line and Curve Attributes-Color and Gray scale levels- Area Fill Attributes- Character Attributes-Bundled Attributes- Inquiry Functions- Anti aliasing.

UNIT –III: **16 Periods**

Two Dimensional Geometric Transformations:

Basic Transformations – Matrix Representations - Homogeneous Coordinates - Composite Transformations - Other Transformations, Transformations between Coordinate Systems, Affine Transformations, Transformation Functions.

Employ

Two Dimensional Viewing:

The viewing Pipeline-Viewing Coordinate Reference Frame-Window-to-Viewport Coordinate Transformation-Two Dimensional Viewing Functions-Clipping Operations-Point Clipping-Line Clipping-Polygon Clipping-Curve Clipping- Text and Exterior Clipping.

Structure And Hierarchical Modeling: Concepts of Structures and Basic models- Editing.

UNIT-IV: **16 Periods**

Employabilit

Three Dimensional Concepts and Object representations & Transformation:

3D display methods - 3D Graphics - Polygon Surfaces - Curved Lines and Surfaces - Quadratic Surfaces-Super Quadrics - Blobby Objects - Spline Representations - Cubic Spline methods - Bezier Curves and Surfaces – B-Spline Curves and Surfaces

Three Dimensional Geometric and Modeling Transformations:

Translation – Rotation - scaling - Other Transformations - Composite Transformations – 3D Transformation Functions.

UNIT-V: **12 Periods**

Three Dimensional Viewing : Viewing Pipeline- Viewing Coordinates- Projections- View Volumes- General Projection Transformations-Clipping-Hardware Implementations- Three Dimensional Viewing.

Employability

Visible Surface Detection Methods: Classification of visible-surface detection algorithms, Bach face method, Depth buffer method, Scan line method.

Text Books:

1. Donald Hearn & M. Pauline Baker,"*Computer Graphics C Version*", 2004, Pearson Education, New Delhi,
2. Zhigang Xiang, Roy A Plastock, "*Schaum's Outlines- Computer Graphics* " adapted by P S Avadhani ,2nd Edition, McGraw Hill.

References Books:

1. David F. Rogers," *Procedural Elements for Computer Graphics*", 2003, Tata McGraw Hill New Delhi.
2. J.D.Foley, S.K Feiner ,A Van Dam. F. H. John "*Computer Graphics-Principles & Practice in C*", 2004,Pearson Education.

Web Resources:

1. http://nptel.ac.in/courses/106106090/
2. https://www.coursera.org/courses?languages=en&query=computer+graphics
3. https://courses.edx.org/courses/BerkeleyX/CS-184.1x/2013_October/syllabus/

COMPUTER NETWORKS	
CSE 314	**Credits : 4**
Instruction **:** 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

- Adequate knowledge of Data Communications.
- Good programming knowledge in C and Java for better understanding of network programming.

Course Objectives:

- To make the student understand the contemporary technologies in network protocols and network architecture.
- To acquire the knowledge on design principles of network infrastructure. ← To learn and understand the design issues in framing and error handling.
- To gain a sufficient knowledge on addressing the nodes in the network and connecting them using the network level protocols.
- To make them familiarize with different application layer protocols and network management elements.

Course Outcomes:

By the end of the course, the student will be able to:

1. Identify the network model and the hardware components at physical layer.
2. Analyze the organization structure; choose the most appropriate network architecture and technology.
3. Contrast connection oriented and connection less services for datagram transformation. Discuss routing algorithms, congestion control algorithms and network layer protocols.
4. Illustrate transport layer, application layer protocols and security issues in transport layer.
5. Analyze domain name system, SNMP architecture and management protocols.

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	2		2	2				1	1				
	2	2	1	2	2	2		1		1		1	1		3
	3	1			1										
	4	2	1		3	2	2	2	1	2	2	1	2	3	1
	5	2	2		2	3				1	1		2	2	2

1-low,2-Medium 3-strong

SYLLABUS

EMPLOYABILITY

UNIT-I: **15 Periods**

Basics of Computer Networks:

Network software architecture- layers and protocol , Reference Models- OSI, TCP/IP and Differences between OSI and TCP/IP, Network Topologies ,ARPANET.

Physical Layer:

Guided and unguided transmission media, wireless transmission media, Hardware components at physical layer, Switching Techniques: Circuit Switching - Packet Switching – Message Switching, Security issues in physical layer.

EMPLOYABILITY

UNIT-II: **15 Periods**

Data link layer and Design issues:

Framing - error detection and correction –checksum, CRC, Elementary Data link Protocols, Sliding Window protocols: Go-back-n , Selective Repeat ,HDLC.

EMPLOYABILITY

Medium Access sub layer:

Channel Allocation Problems Static and Dynamic, Multiple Access protocols: ALOHA - CSMA -CSMACD- IEEE Standard803.3 Ethernet ,802.4 Token bus.

EMPLOYABILITY

UNIT-III: **15 Periods**

Network Layer:

Network Layer design issues, Virtual circuit and Datagram subnets. Store and forward packet switching, Implementation of connection less and connection oriented services and comparisons, Routing Algorithms, Congestion controlling Algorithms, Traffic shaping ,Tunneling, protocols in network layer IPV4,IPV6,DHCP.

EMPLOYABILITY

UNIT-IV: **20 Periods**

Transport Layer:

Transport layer services, Transport layer protocols TCP & UDP, Flow control, Buffering, Multiplexing and Crash recovery, session control protocol, security issues in transport layer.

Application Layer:

The World Wide Web (WWW),Protocols in application layer: HTTP/HTTPS,SMTP,POP,FTP,MIME.

EMPLOYABILITY

UNIT-V: **10 Periods**

The Domain Name System, Resource records, Name services, Electronic Mail concepts, SNMP architecture, SNMP Manager/Agent communication, SNMP management.

Text Books:

1. Andrew S.Tanenbaum, *"Computer Networks"*, Fourth Edition, Pearson Education.
2. Behrouz a Forouzan "*Data Communications and Networking* ", 4th Edition. Tata McGraw-Hill.

Reference Books:

1. William Stallings,"*Data and Computer Communications*",7th Edition , Pearson Education

Web Resources:

1.http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Computer%20networks/New_index1.html
2.https://www.udacity.com/course/computer-networking--ud436
3.https://www.coursera.org/courses?languages=en&query=computer+network
4. https://alison.com/learn/computer-networking

DESIGN AND ANALYSIS OF ALGORITHMS	
CSE 315	**Credits : 4**
Instruction **:** 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Some programming skills and a good back ground in discrete mathematics, data structures and probability will be very helpful.

Course Objectives:

- Student will understand the basic design concepts (e.g., pseudo code, specifications, top-down design).
- Student will learn the different algorithm design strategies (procedural knowledge).
- Student can acquire the knowledge to solve the complexities of different problems.
- Student will able to choose appropriate design strategies for different problems.

Course Outcomes:

CO1: Demonstrate the steps for algorithmic problem solving, types of problems and asymptotic notations. Analyze the recursive and non-recursive algorithms using time and space complexity.
CO2: Analyze the brute force, decrease –and -conquer, divide -and- conquer methods for solving the sorting, searching, permutations and combinations, subset sum, matrix multiplication, convex hull and closest pair problems.
CO3 : Examine the transform-and-conquer, dynamic programming approaches for solving of pre-sorting techniques, heap sort, Balanced Trees, optimal binary search tree, Warshall's & Floyd's algorithms , Knapsack problems.
CO4: Apply prim's, Kruskal's and Dijkstra's for finding a shortest path in a graph. Apply Huffman methods for encode and decode the text.
CO5: Demonstrate the concepts of P , NP and NP-hard problems . Analyze limitations of Back tracking, branch and bound approaches.

Mapping of Course Outcomes with Program Outcomes:

Mapping		**PO**												**PSO**	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	2	2				1	2	2			1	1
	2	2	3	2	3		2	1	1	2	2	1		2	
	3	2	3	2	3	1	2	1	1	2	2	1		2	
	4	2	2	2	3	1	2	1	1	2	2	2	1	1	1
	5	2	3		2				1	2	2	1		1	

SYLLABUS

UNIT-I: 12 Periods

Introduction :

Introduction, Steps for algorithmic problem solving , Important Problem Types Analysis framework (Orders of growth, Cases), Asymptotic Notations and Efficiency Classes, Mathematical Analysis for recursive Algorithms and Non-recursive Algorithms, Empirical

Analysis, Algorithm Visualization.

Case Study: Pseudo code Conventions, Time and Space Complexities

Employability

UNIT-II: 14 Periods

Brute Force:

Brute Force- Selection and Bubble sort, Sequential Search, String Matching, Closest- Pair, Convex Hull Problems, Exhaustive Search -Travelling Salesman problem, knapsack problem, Assignment Problem.

Decrease and Conquer:

Decrease by a constant: Insertion Sort, Algorithms for generating combinatorial problems, Decrease by constant factor algorithms, Variable size decrease.

Divide-and-Conquer :

Merge sort, Quick sort, Binary Search, Multiplication of large integers and Stassen‟s Matrix Multiplication, Closest- Pair, Convex Hull Problems.

UNIT-III: 12 Periods

Transform and conquer:

Presorting, Gauss Elimination, Balanced Trees –2-3 Trees, Heap sort, Horner‟s rule and binary exponentiation, Problem reduction.

Employ

Dynamic Programming:

Computing a Binomial Coefficient, Warshall‟s and Floyd‟s Algorithm, Optimal Binary Search Trees, The Knapsack Problem and Memory Functions.

UNIT-IV: 12 Periods

Greedy Technique: Prim‟s Algorithm, Kruskal‟s Algorithm, Dijkstra‟s Algorithm – Huffman Trees.

Emplo

Space And Time Tradeoffs: Sorting by computing, Input Enhancement in String Matching- Horspool‟s Algorithm, Boyer-Moore Algorithm, Hashing, B-Trees

UNIT-V: 14 Periods

Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees, P, NP and NP complete problems, Challenges of Numerical Algorithms

Coping with the limitations of Algorithms Power – Backtracking, Branch-and-Bound

Case study for Backtracking: Graph Coloring

NP Problems - Approximation Algorithms for NP-hard Problems, Algorithms for solving Nonlinear Equations.

Text Books:

1. Anany Levitin,*"Introduction to Design & Analysis of Algorithms*", 2003, Pearson Education, New Delhi.

Reference Books :

1. Ellis Horowitz, S. Sahni et.al,"*Fundamentals of Computer Algorithms*",2001, Galgotia Pub.
2. Thomas H. Corman, Charles E. Leiserson, Ronald R. Rivest & Clifford Stein, "*Introduction to Algorithms*" Prentice Hall of India, New Delhi
3. Aho, Hopcroft & Ullman,"*The Design and Analysis of computer Algorithms*",2003 Pearson Education, New Delhi
4. Gilles Brassard & Paul Bratley,"*Fundamentals of Algorithmic*", Prentice Hall of India, New Delhi

Web Resources:

1. http://nptel.ac.in/courses/106101060/
2. https://www.edx.org/course/subject/data-analysis-statistics
3. https://www.udacity.com/courses/data-science

4. https://www.coursera.org/specializations/algorithms

DATABASE MANAGEMENT SYSTEMS LAB	
CSE 316	**Credits : 2**
Instruction **:** 3 Periods/Week	Sessional Marks : 50
End Exam : 3 Periods	End Exam Marks : 50

Prerequisites:

Elementary knowledge about computers including some experience using UNIX or Windows.

Course Objectives:

- To understand the basics of SQL and construct queries using SQL.
- To learn connectivity between web pages, OLAP,OLTP.

Course Outcomes:

By the end of the course, the student will be able to:

1. Practise basic SQL queries.
2. Practise compile complex queries like nested queries and joins.
3. Construct triggers, views and stored procedures.
4. Apply the principles of ER model and normalization for refined schema in logical database design.

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	2	2	1	2	1	0	0	1	0	0	0	2	2
	2	2	3	2	2	2	1	0	0	1	0	0	0	2	2
	3	2	3	2	2	2	1	0	0	1	0	0	0	2	2
	4	2	3	3	2	2	1	0	1	3	2	2	2	3	2

SYLLABUS

List of Experiments:

1. SQL DDL ,DML Statements
2. SQL Constraints.
3. Inbuilt functions in RDBMS.
4. Aggregate functions
5. Nested Queries & Join Queries.
6. Creation and dropping of Views.
7. Creating Triggers.
8. Stored Procedures.

EMPLOYABILITY

EMPLOYABILITY

EMPLOYABILITY

Sample Applications:

1. Development of an Online Course Portal for a campus
2. Book Bank Management System
3. Car Rental Management System
4. Exam/academic system for College Management
5. Real estate Management system
6. University Management System
7. Database manager for a Magazine agency or a newspaper agency

EMPLOYABILITY

8. Ticket booking for performances
9. Inventory Control System
10. Students management System

REFERENCE BOOKS:

1. Raghu Ramakrishnan, Johannes *Gehrke "Database Management Systems*", 3rd Edition,
   McGraw- Hill

2. A.Silberschatz.H.Korth, *"Database System Concepts"* , 5th Edition, McGraw-Hill

WEB REFERENCES:

1. https://dev.mysql.com/doc/refman/5.5/en/sql-syntax-data-definition.html

COMPUTER NETWORKS LAB	
CSE 317	**Credits : 2**
Instruction **:** 3 Periods/Week	Sessional Marks : 50
End Exam : 3 Periods	End Exam Marks : 50

Prerequisites:

Basic knowledge of Data communication and programming.

Course Objectives:

- Learn socket programming.
- Be familiar with simulation tools.
- Have hands on experience on various networking protocols.

Course Outcomes:

By the end of the course, the student will be able to:

1. Implement various Network Topologies using Simulation Tools.
2. Implement the various protocols using simulation tools
3. Analyze the performance of the protocols in different layers.
4. Implement and compare various routing algorithms
5. Implement programs using socket

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	3	2	3				2				3	2
	2	2	2	3	1	3				2				2	3
	3	3	2	2	2	2		1		2			1	2	3
	4	3	3	2	2	2		1		2			1	3	2
	5	3	3	2	2	3		1		1			1	2	3

SYLLABUS

LIST OF EXPERIMENTS to be performed using open source tools

1. Implementation of Error Detection and Error Correction Techniques.
2. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
3. Implementation of High level data link control protocol.
4. Study the performance of network with CSMA/CA protocol and compare with CSMA/CD protocols.
5. Simulate network topology STAR ,BUS, RING
6. Study of Socket Programming and Client – Server model.
7. Write a code simulating ARP /RARP protocols.
8. Write a code simulating PING and TRACEROUTE commands.
9. Implementation of Distance vector routing algorithm.
10. Implementation of Link state routing algorithm.

References:

1. Behrouz Forouzan,"*TCP/IP Protocol Suite*",3rd edition, McGraw Hill

COMPILER DESIGN	
CSE 321	**Credits : 4**
Instruction : 4 Periods & 1 Tut/week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Basic fundamentals of Discrete Mathematics
Principles of Automata Theory.

Course Objectives:

- Introduce the major concept areas of language translation and compiler design.
- Learn the design of lexical analyzer, syntax analyzer.
- Enrich the knowledge in various phases of compiler and its use, intermediate code generation, optimization techniques, machine code generation, and use of symbol table.
- Provide practical programming skills necessary for constructing a compiler.

Course Outcomes:

Student will be able to
CO1 - Identify the challenges of theory of computations, Explain different phases of a compiler and design of lexical analyser.
CO2 - Explain differentiate between various parsers and apply top down parsers.
CO3 - Apply bottom up parsers.
CO4 - Differentiate different intermediate code generation techniques
CO5 - Compare different code optimization techniques, how symbol table and run time storage are managed.

Mapping of course outcomes with program outcomes:

Mapping		**PO**												**PSO**	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1											2	1	
	2	2	2	3	1	2				1	1		2	2	
	3	2	2	3	1	2				1	1		2	2	
	4	2	2	2		2					1		2	2	
	5	2	2	2							1		2	2	

SYLLABUS

UNIT-I :

The Theory of Automata: **12 Periods**

Overview of Finite Automata and Formal Languages.

Overall view of Compilers:

Types of Translators, Brief discussion on various phases of Compilers, Design of lexical analyzer, LEX tool.

SKILL DEVELOPMENT

UNIT-II :

Design of Parsers: **10 Periods**

Top down Parsers, Problems with Top down Parsers, Backtracking, Left recursion, Left factorial, Predictive Parser

UNIT-III : **18 Periods**

Bottom up parser: Shift Reduce parser, Operator Precedence Parser, LR parser: LR(0), SLR,CLR parsers. LALR parser, parsing of string, YACC TOOL.

SKILL DEVELOPMENT

UNIT-IV :

Syntax Directed Translation: **18 Periods**

Syntax directed translation and implementation, Intermediate code, Postfix notation, DAG, t Periodsee address Code, Quadruples, and Triples, indirect triples.

Machine independent Code Optimization: The principle sources of optimization, local Optimization, Loop Optimization, DAG, Global data flow analysis.

SKILL DEVELOPMENT

SKILL DEVELOPMENT

UNIT-V :

Code Generation: **18 Periods**

Problems, Machine model, A simple code generator, Machine dependent code Optimization**,** Register allocation and assignment, Code generation from DAG, Peephole optimization.

SSKILL DEVELOPMENT

Brief discussion on symbol tables, Run-time storage administration.

SKILL DEVELOPMENT

Text Book:

1. Aho, D. Ullman "*Principles of Compiler Design*", Second Edition, Pearson Education

Reference Books:

1. Santanu Chattopadhyay, "*Compiler Design*", Sixth Edition,PHI Learning Pvt. Ltd.
2. A.A.Puntambekar , *"Compiler design".* First Edition, Technical Publications .
3. Alfred V. Aho, ,Monica S. Lam, ,Ravi Sethi, Jeffrey D. Ullman, "*Compilers: Principles, Techniques, and Tools*",2nd Edition, Pearson Education

Web resources:

1. http://nptel.ac.in/courses/106104123/.
2. http://www.nptelvideos.in/2012/11/compiler-design.html.

SOFTWARE ENGINEERING	
CSE 322	**Credits : 4**
Instruction : 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Basic Mathematical Knowledge

Basic knowledge on procedural and object oriented programming

Basic knowledge on problem solving.

Course Objectives:

- To make the candidate understand the usage of Engineering Principles to solve complex real time problem by using both Structured and object oriented concepts.
- To learn how to work in groups to find a solution to a given complex problem.
- Learn to Plan a software project based on available resources.
- To manage a Software Project that is being built and to measure the progress and process of building software project.

COURSE OUTCOMES:

1. Classify the process of project life cycle model and design the SRS

2. Summarize & Evaluate the different architecture styles

3. Design the real world system based on Functional Oriented and Object Oriented Approach by using UML & DFD diagrams

4. Apply testing techniques on software products

5. Analyse & estimate the Software quality by using COCOMO model

Mapping of course outcomes with program outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	3	1	1	1	1	1	1	2	3	2	1	3	2
	2	1	1	1	1	1	1	1	1	2	2	2	1	3	1
	3	1	3	3	2	3	1	1	1	3	1	2	1	3	1
	4	1	1	3	1	2	1	1	1	2	1	1	1	3	2
	5	1	2	3	3	1	1	1	1	2	1	1	1	3	1

EMPLOYABILTY

Course Contents:

UNIT-I **16 Periods**

Introduction to Software Engineering – The problem domain, Software Engineering Challenges, Software Engineering approach, Software Engineering Concepts, Software Development Activities.

Software Process – Software Process, Desired Characteristics of Software Process, Software Development Process Models, Effort Estimation with COCOMO Model.

EMPLOYABILTY

Software Requirements Analysis and Specification – Need for SRS, Functional and Non Functional Requirements, Completeness, Consistency, Clarity and Correctness, Problem Analysis, Requirements Specification, Functional Specification with Use Cases an Objected Oriented Approach, Metrics,

EMPLOYABILTY

UNIT-II **10 Periods**

Software Architecture – Role of Software Architecture, Architecture views, Component and Connector View, Architecture Styles, Discussion, Evaluating Architectures

EMPLOYABILTY

UNIT –III **20 Periods**

Design:

Function-Oriented Design – Design Principles, Module –Level Concepts, Structured Design Methodology (Mainly Data Flow Diagram), Metrics,

Object-Oriented Design – OO Concepts, Design Concepts, Unified Modeling Language.

EMPLOYABILTY

UNIT-IV **10 Periods**

Testing – Testing Fundamentals, Black Box Testing, White Box Testing, Testing Process, Metrics,

EMPLOYABILTY

UNIT-V **10 Periods**

Planning a Software Project – Process Planning,Case study on Effort Estimation with COCOMO Model, Project Scheduling – overall and detailed scheduling,Software Configuration Management Plan, Quality Plan,

EMPLOYABILTY

TEXT BOOKS:

1. PankajJalote ,"*An Integrated Approach to Software Engineering"*, Third Edition, Narosa Publication.

REFERENCES BOOKS:

1. Timothy C. Lethbridge,*"Object Oriented Software Engineering (Practical Software Development using UML and Java"* Tata McGraw-Hill.

2. Rajib Mall, "*Fundamentals of Software Engineering"* ,4th edition, PHI

WEB TECHNOLOGIES	
CSE 323	**Credits:4**
Instruction : 4 Periods & 1 Tut/ Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Basic knowledge of computer fundamentals in JAVA programming language.
Student must have knowledge of some programming languages (such as C, C++)

Course Objectives:

- To learn designing of dynamic and interactive web pages by embedding Java Script code in HTML.
- To know how to design and to develop simple database driven web applications using a server-side scripting language –PHP; servlet, JSP technology.
- To describe how a given web server responds to an HTTP request for a dynamic resource.
- To create good, effective and customized websites using HTML, CSS, PHP.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Given the knowledge of HTML, CSS and JAVASCRIPT, Learner is able to Design the static web pages using HTML5, apply styles using CSS and provide dynamic nature to the web pages using JAVASCRIPT to create a good website structure.
2.	Apply the PHP concepts of decision making, looping, form processing, cookies, sessions to create a responsive website, to deploy the website in the server, analyze the browser capabilities.
3.	Understand the need for a web server, servlets-life cycle, servlet API,HTTP Packages for handling http request and responses, cookies, session tracking concepts, compare servlets and CGI in website development with respect to handling request and responses..
4.	Understand Java Server Pages (JSP) objects, variables, error handling, passing control between JSP pages, scope and memory usage of objects, Compare JSP and servlets in website development.
5.	Develop a website to access database content from the user interface using database programming using PHP, Servlets and JSP. Identify the need of JSON in websites by understanding JSON syntax, objects and arrays.

Mapping of course outcomes with program outcomes :

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	1	2	3	-	2	1	1	1	1	1	2	2	-
	2	1	1	2	2	3	2	1	1	1	1	1	2	2	-
	3	1	2	3	-	-	2	1	1	1	1	1	2	2	-
	4	1	2	3	-	-	2	1	1	1	1	1	2	2	-
	5	1	1	2	2	3	2	1	1	1	1	1	2	2	-

SYLLABUS

UNIT-I : **12 Periods**

HTML5 Common tags:

Basics of HTML5, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms,Meta tags, Character entities, frames and frame sets, Web site structure.

Java Script: Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java

UNIT-II : 14 Periods

PHP:

Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP.

EMPLOYABILTY

UNIT –III: 16 Periods

EMPLOYABILTY

Web Servers and Servlets:

Introduction to web server installation.**Introduction** to Servlets: Lifecycle of a Servlet, The Servlet API, The javax.servelet Package, Reading Servlet parameters, Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues.

EMPLOYABILTY

EMPLOYABILTY

UNIT-IV : 16 Periods

EMPLOYABILTY

JSP Application Development:

Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations.

EMPLOYABILTY

UNIT-V : 10 Periods

Database Access:

Database Programming using JDBC, Studying Javax.sql.* package,Accessing a Database from Servlets &JSP Page , Application – Specific Database Action

EMPLOYABILTY

JSON:

Introduction to JSON,JSON syntax, Need of JSON in real web sites,JSON object,JSON array,Complex JSON objects,Reading JSON objects using jQuery

EMPLOYABILTY

Text Books:

1. Dietel and Nieto PHI/Pearson Education Asia., "*Internet and World Wide Web – How to program* ",4th edition,Pearson Education
2. Robin Nixon, " *Learning PHP, MySQL, and JavaScript* ", 4th edition O.Reily
3.Lindsay Bassett ," *Introduction to JavaScript Object Notation*", first edition O.Reily

References Books:

1. Steven Holzner, **"***HTML Black Book: The Programmer's Complete HTML Reference Book"* Coriolis Group Books
2. Hans Bergsten , Java Server Pages, 3rd edition,SPD O"Reilly
3. Deitel/Deitel/Santry ,"*Advanced Java™ 2 Platform How to Program,"*2nd edition,O Reily

Web Resources:

http://www.imad.tech/
https://www.w3schools.com/html/
http://www.javatpoint.com/jsp-tutorial
http://www.javatpoint.com/php-json-example

COMPUTER ARCHITECTURE	
CSE 324	**Credits:4**
Instruction : 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Basic knowledge of Operating Systems and Computer Organization

Course Objectives:

- Understand the Understand the different classes of architecture.
- Understand the memory hierarchy in different classes of computer architecture.
- Learn the basic principle of pipelines and vector processing.
- Know the difference between instruction level and thread level parallel processing.

Course Outcomes:

By the end of the course, the student will be able to:

1. Describe the functional requirements, performance analysis and technology enhancements of different classes of architecture.
2. Explain about different levels of memory arrangement and demonstrate the memory hierarchical arrangement of Arm Cortex-A8 and Intel Core i7.
3. Analyze the principle of instruction level parallelism through pipelining in Intel Corei7 and ARM CORTEX A-8 processors.
4. Analyze the thread level parallelism on distributed shared memory and directory based coherence by applying synchronization techniques in multi core processor environment.
5. Illustrate the workloads for Google warehouse-scale computer.

Mapping of course outcomes with program outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	3							1			1	1	1
	2	1	3		2					1			1	1	1
	3	1	2	3	2					1			1	1	2
	4	1	2	3	2					1			1	1	2
	5	1	2							1			1	1	2

SYLLABUS

UNIT-I : 10 Periods

Quantitative principles of Computer Design:

Overview of Computer organization, Introduction, classes of computer, defining computer architecture, trends in technology and power, measuring and reporting performance, quantitative principles of computer design.

UNIT-II : 12 Periods

Memory hierarchy design:

Introduction, ten advanced optimizations of cache performance, memory technology and optimizations, virtual memory and virtual machines, the design of memory hierarchy, memory hierarchies in Arm Cortex-A8 and Intel Core i7.

UNIT –III: **14 Periods**

Instruction-Level Parallelism and its Exploitation:

Instruction-level parallelism(ILP) - concepts and challenges, basic compiler techniques for exposing ILP, reducing branch costs, overcoming data hazards and dynamic scheduling, hardware based speculation, exploiting ILP using multiple issue and static scheduling, exploiting ILP using dynamic scheduling, multiple issue and speculation, studies of the limitations of ILP, multi-threading, Intel Corei7 and ARM CORTEX A-8.

UNIT-IV : **14 Periods**

Thread Level Parallelism:

Introduction, shared-memory architectures, performance of shared-memory multiprocessors, distributed shared-memory and directory-based coherence, synchronization, models of memory consistency, multicore processors and their performance.

UNIT-V : **12 Periods**

Warehouse-Scale Computers:

Introduction, programming models and workloads for warehouse-scale computers, computer architecture, physical infrastructure and costs, A Google warehouse-scale computer.

Text Books:

1. John L. Hennessy, David A. Patterson,” *Computer Architecture: A Quantitative Approach*”5th Edition, An Imprint of Elsevier.

Reference Books:

1. John P. Shen and Miikko, “*Modern Processor Design : Fundamentals of Super Scalar Processors”*,H. Lipasti , Waveland Press.
2. Kai Hwang, Faye A.Brigs, “*Computer Architecture and Parallel Processing*”, MC Graw Hill.
3. DezsoSima, Terence Fountain, Peter Kacsuk, “ *Advanced Computer Architecture -A Design Space Approach*”, Pearson Ed.

Web Resources:

https://www.coursera.org/learn/comparch

Smart Systems Design & Programming	
CSE 325(A)	**CREDITS: 3**
Instruction: 4 Theory & 1 Tutorial/ Week	**Sessional Marks: 40**
End Exam: 3 Periods	**End Exam Marks: 60**

Prerequisites:

Basic knowledge of Microprocessor & Interfacing, Computer Organization, Digital logic circuits

Student must have knowledge of C programming language.

Course Objectives:

- To learn the design and programming of microcontroller.
- To learn basics of ARM processor.
- To learn to program using ARM assembly language.
- To familiarize the students with Arduino kit and Raspberry Pi to implement small scale embedded system applications.

Course Outcomes:

By the end of the course students will be able:

CO-1:	To describe the Embedded system fundamentals, design and memory management.
CO-2:	To write programs in ARM based assembly level language.
CO-3:	To design Embedded system applications.
CO-4:	To test and debug embedded system applications.
CO-5:	To develop applications on Arduino and Raspberry Pi kits.

Mapping of Course Outcomes with Program Outcomes:

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		2		1		2	1		1	1		1		1
CO2	2	1	1	2	2	1		2	1	2			1	1
CO3		1	2	2	2	1		1	2	1	1	1	1	
CO4		1	2	3	2	1		1	2	1	1	1	1	
CO5	2	2		2	2	1			2	2	2	1	1	

SYLLABUS

UNIT-I **10 Periods**

Introduction to Embedded Systems - Application domain of embedded systems, Desirable features and general features, Figures of merit, classification of MCUs.
Hardware Point of View - Microcontroller Unit, Memory for embedded systems.
Examples – Mobile phone, Automotive electronics, RFID, WISENET, Robotics, Biomedical applications, Brain machine interface

Employability

UNIT-II **10 Periods**

Hardware Software Co-design and Embedded Product Development Lifecycle Management – Hardware Software Co-design, Modeling of systems, Embedded product development lifecycle management, Lifecycle models.
Embedded Design: A Systems Perspective – A typical example, Product design, The design process, Testing, Bulk manufacturing.

Employability

UNIT –III **15 Periods**

ARM Architecture and Assembly Language Programming – History, Architecture, Interrupt vector table, Programming, ARM Assembly language, ARM instruction set, Conditional execution, Arithmetic, logical & compare instructions, Multiplication, Division, Starting ALP, General structure of an Assembly Language Line, Writing

ALP, Branch instructions, Loading Constants, Load and Store instructions.

UNIT-IV **10 Periods**

Introduction to Arduino : What Is Physical Computing?. The Arduino Way, The Arduino Platform, Really Getting Started with Arduino. Advanced Input and Output. Troubleshooting. **Case study:** Automatic Garden-Irrigation System.

Employability

UNIT-V **15 Periods**

Introducing the Raspberry Pi: The History of Raspberry Pi, Exploring the Pi Board, Hardware Requirements of the Pi, The Pi Operating System, Connecting the Peripherals, Configuring the Pi, Getting Started with Python, Accessing the GPIO Pins, Using the GPIO Library in python, Connecting the Temperature/Humidity Sensor, Setting Up the Motion Sensor. **Case Study**: Weather Station

Employability

Text Books:

1. Das, Lyla B, *Embedded Systems: An Integrated Approach*,Pearson Education India, 2013.
2. Donat, Wolfram, *Learn Raspberry Pi Programming with Python*, Apress, 2014.
3. Banzi, Massimo, and Michael Shiloh, *Getting Started with Arduino: The Open Source Electronics Prototyping Platform*, Maker Media, Inc., 2014.

Reference Books:

3. Hohl, William, and Christopher Hinds. *ARM Assembly Language: Fundamentals and Techniques*, Crc Press, 2016.
4. Monk, Simon, *Raspberry Pi cookbook: Software and hardware problems and solutions*, O'Reilly Media, Inc., 2016.
5. Simon Monk, *30 Arduino™ Projects for the Evil Genius*, The McGraw-Hill Companies.

Web Resources:

1. http://nptel.ac.in/syllabus/117106111/
2. Muhammad Ali Mazidi, *ARM Assembly Language Programming & Architecture*, Kindle edition

HIGH PERFORMANCE COMPUTING	
CSE325(B)	**Credits : 4**
Instruction : 4 Periods & 1Tut/ Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Basic fundamentals of Data Structures
Knowledge on Computer Organization, Computer Networks
Exposure to Programming skills in C/C++

Course Objectives:

- Introducing different parallel machines
- Describe high performance computing in the context of scientific computing.
- Understand the concepts of parallel processing as it pertains to high-performance computing

Course Outcomes:

By the end of the course, the student will be able to:

1. Interpret contemporary computing machines, Performance metrics of multicore machines, parallel programs.
2. Apply PCAM methodology, Decomposition patterns for multicore machines, parallel programs.
3. Examine shared memory programming and Thread Management methods.
4. Analyze Loop-level parallelism, Task parallelism and its optimization issues.
5. Estimate Distributed memory programming and communication methods namely point-to-point, Non-blocking communication.

Mapping of course outcomes with program outcomes :

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	1	1	2		1							1	
	2	2	2	1	1		1							1	
	3	2	2	1	2		1	1			1		1		
	4	2	2	2	2		1	1			1	1	1		1
	5	2	2	2	1		1	1			2	1	1		1

SYLLABUS

UNIT I: **12 Periods**

Introduction:

The era of multi core machines , A taxonomy of parallel machines , A glimpse of contemporary computing machines , Performance metrics , Predicting and measuring parallel program performance .

Employability

UNIT II:

Multi core and parallel program design: **15 Periods**

Introduction, The PCAM methodology, Decomposition patterns- Task parallelism, Divide-and-conquer decomposition, Geometric decomposition, Recursive data decomposition, Pipeline decomposition, Event-based coordination decomposition, Program structure patterns- Single-program, multiple-data, Multiple-program, multiple-data, Master-worker, Map-reduce, Fork/join, Loop parallelism, Matching decomposition patterns with program structure patterns.

Employability

UNIT III :

Shared-memory programming: threads **17 Periods**

Introduction, Threads, Design concerns, Semaphores, Applying semaphores in classical problem, Monitors, Applying monitors in classical problems, Dynamic vs. static thread management, Debugging multithreaded applications, Higher-level constructs: multithreaded programming without threads.

Employability

UNIT IV :

Shared-memory programming: OpenMP **17 Periods**

Introduction, first OpenMP program, Variable scope, Loop-level parallelism, Task parallelism , Synchronization constructs . Correctness and optimization issues, A Case study: sorting in OpenMP .

Employability

UNIT V :

Distributed memory programming: **17 Periods**

Communicating processes, MPI Core concepts, MPI program, Program architecture, Point-to-Point communication, Non blocking communications, Point-to-Point communications, Error reporting and handling, Collective communications, Communicating objects, Node management: communicators and groups, One-sided communications, I/O considerations, Combining MPI processes with threads, Timing and performance measurements, Debugging and profling MPI programs

Employability

Text Book:

1. Gerassimos Barlas , " *Multicore and GPU Programming An Integrated Approach* " , 1st Edition, MK Publishers.

Reference Book:

1. Ananth Grama, George Karypis , Vipin Kumar, Anshul Gupta, "*Introduction to Parallel Computing*", 2nd edition , Addison Wesley publishers

Web Resources:

https://www.udacity.com/course/high-performance-computing--ud281
http://nptel.ac.in/courses/106108055/#
http://cs.nyu.edu/courses/fall10/G22.2945-001/lectures.html
http://www.hpc.cam.ac.uk/
http://www.hpc.cam.ac.uk/getting-help/introtohpc-course/view
https://hpc.llnl.gov/training/tutorials
https://www.wolfram.com/training/courses/hpc/
https://www.epcc.ed.ac.uk/online-courses/courses/online-courses/practical-introduction-hpc

PRINCIPLES OF PROGRAMMING LANGUAGES	
CSE325(C)	**Credits: 4**
Instruction : 4 Periods & 1Tut/ Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Basic knowledge of computer fundamentals,

Student must have knowledge of some programming languages (such as C, C++), Functional programming.

Course Objectives:

- To understand the fundamental principles of language design.
- To learn formal syntax and semantics.
- Discuss about control structures and abstractions.
- Introducing data typing and abstractions.

Course Outcomes:

By the end of the course, the student will be able to:

1. Identify the importance of programming languages and programming environments.
2. Analyse the scope of the variables based on the datatypes.
3. Evaluating the expressions and programs for solving a computational problem.
4. Memorize the principles of programming language abstractions.
5. Analyse the concepts of Exception Handling in object oriented programming languages.

Mapping of course outcomes with program outcomes :

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	3	2	1	1			1	3	2	2	3	1	2
	2	2	2	3	3	2		1	1	2	2	1	2	2	2
	3	3	3	3	3	1	1	1	1	2	2	1	3	2	2
	4	2	2	3	1	1	1		1	3	1	1	2	1	2
	5	2	3	3	3	2			1	2	2	1	2	2	2

SYLLABUS

UNIT- I : 15 Periods

Preliminaries:

Reasons for Studying Concepts of Programming Languages, programming Domains Language, Evaluation Criteria, Influences on Language Design, Language Categories, Language Design Trade-Offs, Implementation Methods ,Programming Environments .

Describing Syntax and Semantics:

Introduction, The General Problem of Describing Syntax, Formal Methods of Describing Syntax, Attribute Grammars, Describing the Meanings of Programs: Dyn

EMPLOYABILTY

Lexical and Syntax Analysis :

Introduction, Lexical Analysis, The Parsing Problem , Recursive-Descent Parsing, Bottom- Up Parsing .

EMPLOYABILTY

UNIT- II : 15 Periods

Names, Bindings, and Scopes :

Introduction, Contents , Variables ,The Concept of Binding ,Scope ,Scope and Lifetime, Referencing Environments, Named Constants .

Data Types:

Introduction, Primitive Data Types, Character String Types, User-Defined Ordinal Types Array Types , Associative Arrays , Record Types , Tuple Types , List Types , Union Types Pointer and Reference Types, Type Checking, Strong Typing, Type Equivalence, Theory and Data Types .

EMPLOYABILITY

Expressions and Assignment Statements:

Introduction , Arithmetic Expressions , Overloaded Operators, Type Conversions, Relational and Boolean Expressions, Short-Circuit Evaluation, Assignment Statements , Mixed-Mode Assignment .

EMPLOYABILITY

UNIT-III : 15 Periods

Statement-Level Control Structures:

Introduction , Selection Statements, Iterative Statements, Unconditional Branching Guarded Commands.

EMPLOYABILITY

Subprograms :

Introduction , Fundamentals of Subprograms Design Issues for Subprograms Local Referencing Environments Parameter-Passing Methods, Parameters That Are Subprograms , Calling Subprograms Indirectly , Overloaded Subprograms, Generic Subprograms , Design Issues for Functions , User-Defined Overloaded Operators, Closures , Coroutines.

EMPLOYABILITY

UNIT- IV: 7 Periods

Implementing Subprograms:

EMPLOYABILITY

The General Semantics of Calls and Returns, Implementing "Simple" Subprograms Implementing Subprograms with Stack-Dynamic Local Variables, Nested Subprograms
,Blocks Implementing Dynamic Scoping .

UNIT- V: 10 Periods

Exception Handling and Event Handling :

EMPLOYABILITY

Introduction to Exception Handling, Exception Handling in Ada , Exception Handling in C++ , Exception Handling in Java, Introduction to Event Handling, Event Handling with Java Event Handling in c# .

EMPLOYABILITY

Text Books:

1. ROBERT W. SEBESTA University of Colorado at Colorado Springs "*concepts of programming languages",*Tenth edition
2. Terrence W. Pratt Marvin V. 56 Zelkowitz, **"***Programming languages – Design and Implementation", .*3 rd Edition, Prentice Hall of India.

Reference Books:

1. Fundamentals of Programming Languages, Design & Implementation by Seyed H.Roosta. Vikas publications.1st Edition.
2. Paradigm and Practice – Doris Appleby Julius J. Vendekopple, "*Programming Languages"* 1st Edition., Tata McGraw Hill

Web Resources :

https://web.cs.dal.ca/~nzeh/Teaching/3136/Notes/binding.pdf
www2.hawaii.edu/~pager/313old/slides/pl8ch10.ppt.
cs.boisestate.edu/~alark/cs354/lectures/control_structures.pdf

ADVANCED DATA STRUCTURES	
CSE325(D)	**Credits: 4**
Instruction : 4 Periods & 1 Tut/ Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Knowledge of Data structures.

Student must have knowledge of some programming languages (such as C, C++, Java).

Course Objectives:

- Understand a variety of advanced data structures (skip lists, hash tables, priority queues, balanced search trees, graphs).
- Give the advantages and dis-advantages of each of the advanced data structure.
- Learn how to apply algorithm design techniques and data structures to solve problems.
- Learn different external sorting techniques and analyze their efficiency.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Describe a variety of advanced data structures (skip lists, hash tables, priority queues, balanced search trees, graphs).
2.	Identify different solutions for a given problem; analyze advantages and disadvantages to different solutions.
3.	Demonstrate an understanding of external memory and external sorting algorithms.
4.	Apply learned algorithm design techniques and data structures to solve problems.
5.	Master a variety of advanced abstract data type (ADT) and data structures and their implementations.

Mapping of course outcomes with program outcomes :

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	1	1	1	1							1	2	2
	2	1	3	3	2								1	3	3
	3	2	1	1	1									2	2
	4		3	3	3	1							1	3	3
	5	3	2	2	2	1							1	3	3

SYLLABUS

UNIT-I : **12 Periods**

Skip lists and Hashing:

Sets, Map, Dictionaries, representation of dictionary as ADT,Linear list, skip list, hash table representation, an application-text compression using dictionary.

EMPLOYABILITY

UNIT-II : **15 Periods**

Balanced Search Trees:

Red-black trees, Representation of Red-black tree, Insertion, Deletion and searching of nodes in Red-black tree. Splay trees, B-Trees, Indexed Sequential Access Method(ISAM), B-Trees of order m, Representation of B-Tree, Insertion, deletion and searching a node in B-Tree.

EMPLOYABILITY

UNIT-III : **12 Periods**

Priority Queues:

Binary heap, Applications of priority queues, leftist heaps, Binomial queues.

UNIT-IV: **12 Periods**

Sorting:

Shell sort, Heap sort, Quick sort, Indirect sorting, decision trees, bucket sort, External sorting.

UNIT-V : **12 Periods**

Graphs:

Graph algorithms-Topological sorting, shortest-path algorithms- unweighted shortest path, graphs with negative edge cost, acyclic graphs, Network flow problems, Applications of DFS. Introduction to NP-Completeness.

EMPLOYABILITY

Tex EMPLOYABILITY

1. SartajSahni,"*Data Structures, Algorithms and Applications in C++",* SecondEdition,University Press
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++" , Third Edition, Pearson Education.

Reference Books:

1 Richard F.Gilberg, Behrouz A.Forouzan, "*Data Structures: A Pseudocode Approach with C",* Second Edition, Cengage Learning.

2. NB Venkateswarulu and EV Prasad, "*C and Data structures: A Snap Shot Oriented Treatise with Live Examples from Science and Engineering"*, S Chand, 2010.

Web Resources:

1. http://nptel.ac.in/courses/106102064/
2. http://nptel.ac.in/courses/106103069/

DIGITAL IMAGE PROCESSING	
CSE325(E)	**Credits: 4**
Instruction : 4 Periods & 1Tut/ Week	Sessional Marks : 40
End Exam : 3 Periods	End Exam Marks : 60

Prerequisites:

Knowledge of computer graphics,
Basic knowledge of linear algebra,
Basic knowledge of probability and statistics,
Basic programming skills (C/ Matlab preferred).

Course Objectives:

- To make the students to be familiar with basic image processing techniques for solving real problems,
- To make the students to have general overview on digital image processing concept along with its uses and applications,
- To make the students gain knowledge about representation of a digital image in different domains and the transformations between those domains,
- To make the students learn about various morphological operations on a digital image.

Course Outcomes:

By the end of the course, the student will be able to:

1. Apply the basic concepts of 2D image acquisition, sampling, quantization, relationships between pixels and components of image.
2. Analyze the filtering techniques in spatial domain for face reorganization, pattern reorganization and segmentation.
3. Analyze and apply the filtering techniques in frequency domain for classify the images.
4. Apply image morphological techniques for manipulate digital images
5. Apply the image Segmentation techniques on Edge detection and Region-Based Segmentation.

Mapping of course outcomes with program outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	2	1	2	2	0	1	1	1	1	1	1	1	3
	2	3	3	2	2	2	0	0	0	1	1	1	1	1	3
	3	3	3	2	2	2	0	0	0	1	1	1	1	1	3
	4	3	2	3	3	3	2	1	1	2	2	2	2	2	3
	5	3	1	3	3	3	2	1	1	2	2	2	2	2	3

SYLLABUS

UNIT-I : 08 Periods

EMPLOYABILITY

Introduction to Digital Image Processing:

Origins, Applications, Fundamental Steps, Components of a digital image processing system; Image Sensing and acquisition, Simple image formation model; Image Sampling and Quantization; Basic relationships between pixels; Mathematical tools used in DIP.

EMPLOYABILITY

UNIT-II : 10 Periods

Intensity Transformations and Spatial Filtering:

Background; Basic intensity transformation functions; Histogram Processing; Fundamentals of spatial filtering; Smoothing spatial filters; Sharpening spatial filters; Combining spatial enhancement methods.

EMPLOYABILITY

UNIT –III : 12 Periods

Filtering in the Frequency Domain:

Background; Preliminary concepts; Discrete Fourier transform of one and two variables, Properties of the 2D- Discrete Fourier transform; The basics of filtering in the frequency domain; Image smoothing using frequency domain filters; Image Sharpening Using Frequency Domain Filters; The fast Fourier transform.

EMPLOYABILITY

EMPLOYABILITY

UNIT-IV : 7 Periods

Morphological Image Processing:

Preliminaries; Erosion and Dilation; Opening and closing; the Hit-or-Miss transformation; Basic morphological algorithms; Gray-Scale morphology.

UNIT-V : 8 Periods

Image Segmentation:

Fundamentals; Point, Line, and Edge Detection; Thresholding; Region-Based Segmentation; Segmentation using morphological watersheds.

EMPLOYABILITY

Text Book:

1. Gonzalez Rafael C and Woods Richard E," *Digital Image Processing*", 3rd Edition, Prentice Hall, 2008.

Reference Books:

1. Pratt William K, "*Digital Image Processing: PIKS Scientific Inside*", 4th Edition, John Wiley, 2007. (TA1632.P917 2007) •

2. Pitas Ioannis, "*Digital Image Processing Algorithms and Applications*", John Wiley, 2000. (TA1637.P681) •

3. Jain Anil K, "*Fundamentals of Digital Image Processing*", PrenticeHall, 1989. (TA1632.J25)

Web Resources:

http://nptel.ac.in/courses/117105079/

NOSQL DATABASES	
CSE325(F)	**Credits:4**
Instruction : 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Periods	Ena Exam Marks : 60

Prerequisites:

Knowledge on Relational Database management systems.

Course Objectives:

- Distinguish and describing how NoSQL databases differ from relational databases from a theoretical perspective.
- Explore the origins of NoSQL databases and the characteristics .
- Demonstrate competency in selecting a particular NoSQL database for specific use cases.
- Demonstrate Document databases with MongoDB.

Course Outcomes:

By the end of the cource, the student will be able to:	
1.	Compare and contrast the uses of relational RDBMSs and NoSQL systems for different types of data and applications.
2.	Differentiate various data models.
3.	Differentiate Key value Databases and document databases.
4.	Create a sample database using NoSql.

Mapping of course outcomes with program outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	3	1		3									3
	2	1	2			3									3
	3		3	1	3	3									3
	4		3	1	2	3							2		
	5					3								3	3

SYLLABUS

UNIT-I : Why NoSQL? **10 Periods**

The value of relational databases – Impedance mismatch – Application and integration databases – Attack of the cluster.

Employability

UNIT-II :

Aggregate Data Models : **18 Periods**

Aggregates - Example of Relations and Aggregates – Consequences of Aggregate Orientation - Key-Value and Document Data Models - Column-Family Stores

More Details on Data Models :

Relationships - Graph Databases - Schemaless Databases - Materialized Views - Modeling for Data Access.

Employability

UNIT –III :Distribution Models : **16 Periods**
Single Server – Sharding - Master-Slave Replication - Peer-to-Peer Replication – Combining Sharding and Replication

UNIT-IV :ey-Value Databases: **16 Periods**
What Is a Key-Value Store - Key-Value Store Features – Consistency – Transactions - Query Features - Structure of Data – Scaling - Suitable Use Cases - Storing Session Information - User Profiles, Preferences - Shopping Cart Data - When Not to Use - Relationships among Data - Multioperation Transactions - Query by Data - Operations by Sets.

Employability

UNIT-V : Document Databases: **20 Periods**
What Is a Document Database? – Features – Consistency – Transactions – Availability - Query Features – Scaling - Suitable Use Cases - Event Logging - Content Management Systems - Blogging Platforms - Web Analytics or Real-Time Analytics - E-Commerce Applications - When Not to Use - Complex Transactions Spanning Different Operations - Queries against Varying Aggregate Structure.

Employability

Introduction to MongoDB:
Introduction to MongoDB - The Data Model - Working with Data – GridFS.

TEXT BOOK:

1. Pramod J.Sadalag and Martin Fowler," *NoSQL Distilled, A Brief Guide to the Emerging World of Polyglot Persistence*" ,1st Edition, Addison Wesley
2. David Hows, Eelco Plugge, Peter Membrey , and Tim Hawkins, "*The definitive guide to MongoDB*", "*A complete guide to dealing with big data using MongoDB*". 1st Edition, Apress

Web Resources:

1. http://allvideolectures.com/courses/course/96uv57kBOZ.
2. https://university.mongodb.com/

OPEN SOURCE TECHNOLOGIES LAB	
CSE 326	**Credits : 2**
Instruction : 3 Hr lab/Week	Sessional Marks : 50
End Exam : 3 Periods	End Exam Marks : 50

Prerequisites:

- Basic knowledge of Computer Networks
- Exposure to Problem solving techniques and programming skills

Course Objectives:

- Introducing Open Source project development to students.
- Introducing Open Source Technologies- HTML,CSS, JAVASCRIPT,PHP,MYSQL,
- APACHE.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Understand and analyze an open source software project.
2.	Examine open source project workflow using github.
3.	Develop static web pages using HTML, CSS.
4	Develop a dynamic web site with Client side scripting language-Javascript and Server side scripting language-PHP
5.	Integrate PHP, JAVASCRIPT and MYSQL technologies in open source environments to develop a complete web site and deploy the website using WAMP/MAMP/LAMP/XAMP Servers.

Mapping of course outcomes with program outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	3	-	-	-	-	1	1	-	1	-	2	1	-
	2	2	3	-	-	-	-	1	1	-	1	-	2	1	-
	3	1	2	2	2	3	2	2	1	2	1	1	2	1	-
	4	1	2	2	2	3	2	2	1	2	1	1	2	1	-
	5	1	2	2	2	3	2	2	1	2	1	1	2	1	-

SYLLABUS

LIST OF EXPERIMENTS:

1 week

Technical report on Open Source Software Development Style and famous open source projects

GITUB(version Control System) **2 weeks**

Install git and create a GitHub account, Create a local git repository, Add a new file to the repository, Add a file to the staging environment, Create a commit, Create a new branch, Create a new repository on GitHub.

Employability

HTML & Java Script(Technologies for Client Side Programming) **4 weeks** HTML basic tags, HTML forms. Java script Basics, JavaScript syntax, Statements, Comments,
Variables, Operators, If...Else, Popup Boxes, For Loop, While Loops, Events, Functions, Objects.

Employability

PHP(Technology for Server Side Programming) **5 weeks**

Creating simple webpage using PHP, Use of conditional statements in PHP, Use of looping statements in PHP, Creating different types of arrays, Usage of array functions, Creating user defined functions, Creation of sessions, cookies, Creation of cookies, Database connectivity in PHP with MySQL, Validating Input, Formatting the Output

Employability **3 weeks**

Developing an Open Source Project using PHP,MySQL,Java Script and uploading in GitHub

.

Employability

Text Books :

1. Dietel and Nieto, *" Internet and World Wide Web – How to program* ", 4th Edition PHI/Pearson Education Asia.
2. Steven Holzner, " *PHP : Complete reference*", 1st Edition, McGraw Hill Education

Reference Books:

Web Resources:

https://www.udacity.com/course/how-to-use-git-and-github--ud775
https://www.codecademy.com/learn/learn-git
https://www.coursera.org/learn/html-css-javascript
https://www.coursera.org/learn/duke-programming-web
https://www.w3schools.com/php/

SOFTWARE ENGINEERING LAB/MINI PROJECT LAB	
CSE 327	**Credits: 2**
Instruction: 3 Hr lab/ Week	Sessional Marks : 50
End Exam : 3 Periods	End Exam Marks : 50

Prerequisites:

Object Oriented Programming.

Course objectives:

- To impart state-of-the-art knowledge on Software Engineering and UML in a practical and interactive manner through an interactive simulation and hands on.
- To present sample case studies to demonstrate practical applications of different concepts.
- To provide a scope to students where they can solve small, real life complex problems.

Course Outcomes:

1. Analyze the case study and apply the UML notations.
2. Estimate the project metrics using COCOMO and estimate the complexity using McCabe's Cyclomatic method
3. Compare and contrast testing techniques

Mapping of course outcomes with program outcomes :

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	3	3	3	2	1	1	2	3	1	2	3	3
	2	1	2	3	3	1	2	2	1	1	1	2	1	3	2
	3	1	2	3	3	1	1	1	2	2	2	1	2	3	2

SYLLABUS

LIST OF EXPERIMENTS :

Identifying Requirements from Problem Statements: **1 week**

Requirements, Characteristics of Requirements, Categorization of Requirements, Functional Requirements, Identifying Functional Requirements, Preparing Software Requirements Specifications

EMPLOYABILITY

Estimation of Project Metrics: **1 week**

Project Estimation Techniques, COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics

EMPLOYABILITY

EMPLOYABILITY

Modeling UML Use Case Diagrams and Capturing Use Case Scenarios: **1 week**

Use case diagrams, Actor, Use Case, Subject, Graphical Representation, Association between Actors and Use Cases, Use Case Relationships, Include Relationship, Extend Relationship, Generalization Relationship, Identifying Actors, Identifying Use cases, Guidelines for drawing Use Case diagrams

Identifying Domain Classes from the Problem Statements: **1 week**
Domain Class, Traditional Techniques for Identification of Classes, Grammatical Approach Using Nouns, Advantages, Disadvantages, Using Generalization, Using Subclasses, Steps to Identify Domain Classes from Problem Statement, Advanced Concepts

Statechart and Activity Modeling: **1 week**
Statechart Diagrams, Building Blocks of a Statechart Diagram, State, Transition, Action, Guidelines for drawing Statechart Diagrams, Activity Diagrams, Components of an Activity Diagram, Activity, Flow, Decision, Merge, Fork, Join, Note, Partition, A Simple Example, Guidelines for drawing an Activity Diagram

Modeling UML Class Diagrams and Sequence Diagrams: **1 week**
Structural and Behavioral Aspects, Class diagram, Class, Relationships, Sequence diagram, Elements in sequence diagram, Object, Life-line bar, Messages

Modeling Data Flow Diagrams: **1 week**
Data Flow Diagram, Graphical notations for Data Flow Diagram, Symbols used in DFD, Context diagram and leveling DFD

Estimation of Test Coverage Metrics and Structural Complexity: **1 week**
Control Flow Graph, Terminologies, McCabe's Cyclomatic Complexity, Computing Cyclomatic Complexity, Optimum Value of Cyclomatic Complexity, Merits, Demerits

EMPLOYABILITY

EMPLOYABILITY

Designing Test Suites: **1 week**
Software Testing, Standards for Software Test Documentation, Testing Frameworks, Need for Software Testing, Test Cases and Test Suite, Types of Software Testing, Unit Testing, Integration Testing, System Testing, Example, Some Remarks

EMPLOYABILITY

Text Books:

1. PankajJalote, "*An Integrated Approach to Software Engineering*", Third Edition, Narosa Publication.
2. Object Oriented Software Engineering by Bernd Bruegge and Allen H. Dutoit, Second Edition, Pearson Publication.

Reference Books:

1. Timothy C. Lethbridge, "*Object Oriented Software Engineering (Practical Software Development using UML and Java)* " , Tata McGraw-Hill.
2. Rajib Mall, " *Fundamentals of Software Engineering*", 4th edition, PHI

CRYPTOGRAPHY AND NETWORK SECURITY	
CSE 412	**Credits : 3**
Instruction **:** 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

- COMPUTR NETWORKS
- NUMBER THEORY
- PROBABILITY THEORY

Course Objectives:

The student will be able to:

- Learn OSI Security Architecture and Threats-Attacks & Attack Types-Services-Mechanisms in various layers
- Understand symmetric and asymmetric key cryptographic algorithms.
- Learn various key management algorithms and hashing techniques to achieve integrity.
- Acquire knowledge on application and network layers security.

Course Outcomes:

By the end of the course, the student will be able to:

1. Memorizing the concepts of Cryptographic systems.
2. Interpret the application of Cryptographic Techniques in Network Security.
3. Apply the algorithms to achieve the security goals of Confidentiality, Authentication and Integrity to a given application.
4. Determine the applications of authentication mechanisms.
5. Illustrate the techniques of Intrusion Detection systems and Firewalls.

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	3	1	2	3	3	1	2	3	1	1	1		2
	2	3	3	3	2	1	2	1	1	2	1	2	1	3	2
	3	2	2	3	2	1	1	3	2	2	1		2	1	3
	4	2	2	3	3	2		2	1	2	1	3	2	1	3
	5	2	3	3	2	3	2	1	2	2	1	1	2	1	2

SYLLABUS

UNIT 1: INTRODUCTION TO CRYPTOLOGY **14 periods**

Cryptography, Need for Security, Security Goals, Security Methodology, OSI Security Architecture: Threats-Attacks & Attack Types-Services-Mechanisms, Network Security Model: Plain Text-Cipher Text-Encryption-Decryption-Key, Key Range and Key Size, Classic Cryptography: Substitution-Transposition, Steganography. Basic Concept of Symmetric Cryptography, Algorithm Types and Modes, Principles of Public-Key Cryptography.

UNIT1 2:CONFIDENTIALITY **12 periods**

Symmetric Cryptography Techniques: Feistel Structure, DES-AES-RC4

Asymmetric Cryptography Techniques: Encryption/Decryption using RSA, Encryption/Decryption using Elliptic Curve Cryptography, Digital Envelope

Employability Skill

UNIT 3: KEY MANAGEMENT AND INTEGRITY: **12 periods**

Employability Skill

Key Distribution And Management: RSA Key Exchange, Diffie-Hellman Key Exchange, Digital Certificates (public key), Private Key Management.
Hashing: Cryptographic Hash Function Definition, Applications of Cryptographic Hash Functions, Message Authentication Functions, SHA-256

UNIT 4: AUTHENTICATION **10 periods**

Authentication Using Asymmetric Cryptography(Digital Signatures): Basic Idea of Digital Signatures, RSA Digital Signature Scheme, Digital Signature Standard,Kerberos.

UNIT 5: NETWORK SECURITY: **12 periods**

Application Layer: PGP, S/MIME, Transport Layer: TLS, SSL, Network Layer: IP Security Intrusion Detection Systems (IDS): Types of IDS Technologies, False Positives and Negatives, Intrusion Detection Techniques, Firewalls: Definition, Packet Filters, Circuit Level filters, Application Layer Filters

Employability Skill

TEXTBOOK:

1) Cryptography and Network Security, Forouzan and Mukhopadhyay, 2nd edition, TMH.
2) Cryptography and Network Security: Principles and Practice, William Stallings, 5th edition, Pearson.

REFERENCES:

1) Cryptography and Network security, AtulKahate, Tata McGraw-Hill Pub company Ltd., New Delhi
2) Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi.
3) Network Security: The Complete Reference, Robert Bregga, Mark Rhodes-Ousley, Keith Strassberg, TMH.

OBJECT ORIENTED ANALYSIS AND DESIGN	
CSE 413	**Credits:4**
Instruction:4 Periods & 1 Tut/Week	Sessional marks:40
End Exam: 3 Periods	End Exam Marks:60

Prerequisites:

1. Basic Knowledge of Programming Fundamentals
2. Basic knowledge on procedural and object oriented programming.
3. Basic knowledge on problem solving.

Course Objectives:

- To learn the concept of Object Oriented Software Development Process
- To get acquainted with UML Diagrams
- To understand Object Oriented Analysis Processes
- To make them understand different problems in design along with learning how solve them using design patterns

Course Outcomes:

By the end of the course, the student will be able to

1. Outline the concepts & principles of Object Oriented Programming
2. Model UML diagrams according to object oriented Methodologies
3. Summarize on Object oriented Analysis & Identify the Classes
4. Structuring the basics of object Oriented Design along with patterns
5. Design Access Layer ,View layer & protocols for classes

CO – PO MAPPING:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	2	3	2	2				2				**2**	**1**
CO 2	1	2	3	1	1	1				1	1	1	**2**	**1**
CO 3	1	1	2	2			2			1	1	1	**2**	**1**
CO 4	1	1	2	2			1	1		1	1	1	**3**	**1**
CO 5	1	1	2	1		1	1	1		1	1	1	**2**	**2**

SYLLABUS

Unit I **10 periods**

EMPLOYABILITY

Object Basics, Object oriented philosophy, objects, classes, attributes, object behaviour and methods, encapsulation and information hiding, class hierarchy, polymorphism, object relationships and associations, aggregations and object containment, case study, object identity, persistence.. Object oriented systems development life cycle: Software development process, building high quality software, use- case driven approach, reusability.

Unit II **12 periods**

EMPLOYABILITY

Object Oriented Methodologies: Rumbaughetc all object modelling technique, Booch methodology, Jacobson et al methodologies, patterns, frameworks, the unified approach. Unified modelling language: Static and dynamic models, UML diagrams, UML class diagrams, use-case diagrams, UML dynamic modelling, packages, UML extensibility and UML meta model.

Unit III **16 periods**

EMPLOYABILITY

Object Oriented Analysis Process: Business object analysis, use-case driven object oriented analysis, business process modelling, use-case model, developing effective documentation, case study. Classification: Classification theory, noun phrase approach, common class patterns approach, use-case driven approach, classes, responsibilities, and collaborators, naming classes.

EMPLOYABILITY

Unit IV **12 periods**

EMPLOYABILITY

Identifying Object Relationships, Attributes and Methods: Association, super-subclass relationships, a- part of relationships, case study, class responsibility, defining attributes for via net bank objects, object responsibility, defining methods for via net bank objects Design process and design axioms: Corollaries, design patterns.

Unit V **10 periods**

Designing Classes: UML object constraint languages, designing classes, class visibility, refining attributes for the via net bank objects, designing methods and protocols, designing methods for the via net bank objects, packages and managing classes. Designing access layer, case study.Designing view layer, macro level process.

Text Book :

EMPLOYABILITY

Ali Bahrami, Object Oriented Systems Development using the Unified Modelling Language, McGraw Hill, Reprint 2009.

Reference Books:

1. Craig Larman : Applying UML and Patterns, Pearson Education, 2002
2. Grady Booch: Object-oriented analysis and design, Addison – Wesley, 1994.

Web resources:

:http://www.informit.com/store/product.aspx?isbn=020189551XAddison-Wesley 2007.

https://www.tutorialspoint.com/object_oriented_analysis_design/

MOBILE COMPUTING(PROFESSIONAL ELECTIVE-II)	
CSE 414(A)	**Credits:4**
Instruction:4 Periods & 1 Tut/Week	Sessional marks:40
End Exam: 3 Periods	End Exam Marks:60

PREREQUISITE: Data Communication,

Computer Network

Course Objectives:

- To make the student understand the concept of mobile computing terminology and basic services.
- To interpret the knowledge on working principle of wireless technology and applications of wireless protocols.
- To make the student aware of various architectures and technologies in mobile networking.
- To gain sufficient knowledge on various routing mechanisms.

COURSE OUTCOMES:

CO-1: Interpret the GSM architecture and its services.
CO-2: Analyze the various wireless applications and study technical feasibility of various mobile applications.
CO-3: Utilize the mobile network layer protocols and its functionalities.
CO-4: Analyze & develop any existing or new models of mobile environments for 3G networks.
CO-5: Evaluate and create the platform, protocols and related concepts of Ad hoc and Enterprise wireless networks

	PO A	PO B	PO C	PO D	PO E	PO F	PO G	PO H	PO I	PO J	PO K	PO L	PSO 1	PSO 2
CO 1	2	2	1	1	1					1		2		1
CO 2	2	1	2	2	2							1		1
CO 3	1	2	3											1
CO 4	3	2	3	2	2					1				
CO 5	2	2	2	3	1					2	2	2		2

SYLLABUS

UNIT-1 **12Periods**

Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.

Global System for Mobile Communication(GSM): Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, New Data Services, GPRS Architecture, GPRS Network Nodes.

Employability

UNIT-2 **12 Periods**

Medium Access Control (MAC) : Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), Wireless LAN/(IEEE 802.11) architecture, key IEEE802.11 a/b/c/d/e/g/i/n/T/ac/ standards.

Employability

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.

UNIT-3 **12 Periods**

Mobile Network Layer : IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization using Soft computing techniques – ANT Bee colony, Support Vector Machine, Particle Swarm Optimization and Genetic Algorithm.

Employability

UNIT-4 **12 Periods**

Mobile Transport Layer : Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP.

Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA) and CDMA 2000, Quality of services in 3G.

Employability

UNIT-5 **12 Periods**

Mobile Ad hoc Networks (MANETs) : Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service Discovery ,case study using NS2 –traffic analysis using CBR and VBR

Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.

Employability

TEXTBOOKS:

1. Jochen Schiller, "Mobile Communications", Addison-Wesley, Second Edition, 2009.
2. Raj Kamal, "Mobile Computing", Oxford University Press, 2007, ISBN: 0195686772

REFERENCE BOOKS:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing, Technology Applications and Service Creation" Second Edition, McGraw Hill.
2. Martin Sauter, "From GSM to LTE-Advanced: An Introduction to Mobile Networksand Mobile Broadband," Second Edition, Wiley.

Web Resource:

1. https://onlinecourses.nptel.ac.in/noc18_cs09/preview
2. http://studentnet.cs.manchester.ac.uk/pgt/2014/WelcomeWeek/slides/MobCompI ntro2013-NPF.pdf

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY &&SCIENCES(Autonomous)

DEPARTMENT OF COMPUTER SCIENCE && ENGINEERING

B TECH COURSE PROPOSED SCHEME UNDER AUTONOMOUS SYSTEM 2015-16

PROFESSIONAL ELECTIVE – II

DISTRIBUTED OPERATING SYSTEMS	
CSE 414(B)	**Credits : 4**
Instruction **:** 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Distributed Operating Systems

Objectives:

- To provide an overview of the concepts of distributed operating systems and challenges that includes Architecture and Fundamental Models.
- To explore about various types of communication procedures and protocols in a distributed operating systems environment.
- To interpret the concept of communication between distributed objects and remote procedural calls.
- To analyse and understand the concepts of Distributed File system.
- To demonstrate the idea of Transactions and Replications in distributed operating system.

Outcomes:

By the end of the course student will be able to:

Co1: Analyze the system model, software layers of distributed operating systems and its challenges.

C02: Examine the inter-process communication, TCP stream communication procedures and protocols.

Co3: Evaluate the concepts of Remote procedural calls and communication among objects in distributed operating system.

Co 4: Apply the knowledge of peer-to-peer system, distributed mutual exclusion of distributed file system in real world scenario

Co5: Apply concurrency control, deadlock management techniques in distributed operating system for group communication.

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	3	1	2	1	1	1	1	0	1	0	1	1	1
	2	1	3	2	2	1	1	0	1	0	0	1	1	1	1
	3	1	2	3	3	1	1	0	0	0	0	1	1	1	1
	4	3	1	1	3	1	1	1	1	0	0	1	1	1	1
	5	3	1	1	3	1	0	1	0	0	0	0	1	1	1

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY &&SCIENCES(Autonomous)

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B TECH COURSE PROPOSED SCHEME UNDER AUTONOMOUS SYSTEM 2015-16

SYLLABUS

UNIT-I: **12 periods**

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges. System Models: Introduction, Architectural Models-Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.

Employability

UNIT-II: **12 periods**

Inter process Communication: Introduction, The API for the Internet Protocols- The Characteristics of Inter process communication, Sockets, UDP Datagram Communication, TCP Stream Communication; External Data Representation and Marshalling; Client Server Communication; Group Communication- IP Multicast- an implementation of group communication, Reliability and Ordering of Multicast,

Employability

UNIT-III: **10 periods**

Distributed Objects and Remote Invocation: Introduction, Communication between Distributed Objects- Object Model, Distributed Object Modal, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection; Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI

Employability

Employability

UNIT-IV: **12 periods**

Distributed File Systems: Introduction, File Service Architecture; Peer-to-Peer Systems: Introduction, Napster and its Legacy, Peer-to-Peer Middleware, Routing Overlays. Coordination and Agreement: Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication.

Employability

UNIT-V: **12 periods**

Transactions & Replications: Introduction, System Model and Group Communication, Concurrency Control in Distributed Transactions, Distributed Dead Locks, Transaction Recovery; Replication-Introduction, Passive (Primary) Replication, Active Replication.

ployability

Text Books:

1. Ajay D Kshemkalyani, MukeshSighal, “Distributed Computing, Principles, Algorithms and Systems”, Cambridge.
2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems- Concepts and Design”, Fourth Edition, Pearson Publication.

Reference Books :

1. Advanced Concepts in Operating Systems, Makes Singhal and NiranjanG.Shivaratna, Tata McGraw Hill Edition.

Web Resources:

1. https://www.coursera.org/learn/distributed-programming-in-java
2. https://www.edx.org/course/javacheng-xu-she-ji-java-programming-pekingx-04830340x
3. https://www.coursera.org/courses?languages=en&query=java

PROFESSIONAL ELECTIVE – II

NEURAL NETWORKS & DEEP LEARNING	
CSE 414 (C)	**Credits : 3**
Instruction **:** 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:
Linear Algebra, Probability Theory, Algorithms.

Course Objectives:

- Introduce neural networks and different network architectures.
- Provide applications oriented knowledge for neural networks
- Provide knowledge on deep neural networks

Course Outcomes: By the end of the course, the student will be able to

1.Examine different neural network architectures.

2.Describe the underlying mathematics in neural networks and deep learning algorithms.

3.Select an appropriate neural network approach for a given task.

4.Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.

5.Implement neural networks & deep learning algorithms and solve real-world problems.

Mapping of Course Outcomes with Program Outcomes:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	1	1	1	1									1	1
CO-2	3	2	2	1									1	2
CO-3	2	2	2	2								1	1	2
CO-4	1	2	2	3								1	1	2
CO-5	1	2	2	2	3							1	1	2

SYLLABUS

Introduction to soft Computing

UNIT-I: **12 periods**

Introduction to neural networks: Human brain and models of a neuron, Network architectures.

Learning processes: Error correcting learning, memory-based learning, Hebbian learning, competitive learning, Boltzman learning;

UNIT-II: **12 periods**

Single-layer perceptrons: Unconstrained optimization, LMS algorithm, learning curves, perceptrons, convergence theorem, limitations of single-layer perceptrons;

Multi-layer perceptrons: Back-propagation algorithm, XOR problem, feature detection, accelerated convergence of back-propagation algorithm, limitations;

Case study: Feed forward Networks for Handwritten Digit Recognition using keras with theano

EMPLOYABILITY

UNIT-III: **10 periods**

Convolutional networks: Convolution operation, motivation, pooling, convolution and pooling as an infinitely strong prior, variants of basic convolution function, efficient convolution algorithms

Recurrent and recursive networks: Recurrent neural networks, bidirectional RNNs, Encoder-decoder sequence-sequence architectures, deep recurrent networks, LSTMs, Autoencoders

Case study: Image Classification with Convolutional Networks using keras with theano

EMPLOYABILITY

EMPLOYABILITY

UNIT-IV: **12 periods**

Hopfield nets and Boltzmann machines : Boltzmann machines, restricted boltzmann machines, deep melief networks, deep boltzmann machines

UNIT-V: **12 periods**

Current areas of research and recent applications of deep neural nets – GANs, GRUs

EMPLOYABILITY

Text Books:

1. Simon Haykin "*Neural Networks, A comprehensive Foundation*", Second Edition, Pearson Education.

2. Ian Goodfellow, YoshuaBengio, Aaron Courville " Deep Learning", MIT Press,2016

Reference Books :

1. Simon Haykin*, "Neural Networks and Learning Machines",Third Edition,* Pearson Education

Web Resources:

1. Coursera - Neural networks and deep learning
2. Stanford CS231n – Convolutional Neural networks for visual recognition
3. Stanford CS224n – Natural Language Processing with deep learning
4. Github - https://github.com/search?q=topic%3Aneural-network&type=Repositories

PROFESSIONAL ELECTIVE – I (for CSE Students)

HUMAN COMPUTER INTERACTION	
CSE 414 (D)	**Credits : 4**
Instruction **:** 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Student should have an idea about User Interface Design and Programming

Course Objectives:

The main objective is to get student to think constructively and analytically about how to design and evaluate interactive technologies.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Make use of four pillars of design, participatory design, scenario development of design processes that supports social, ethical and legal issues.
2.	Apply an interactive design process and universal design principles to design HCI systems.
3.	Analyze Importance of response time, attitudes and user productivity related to quality of service on Display Design, Web Page Design, Window Design HCI Systems.
4.	Distinguish the online user documentation from paper documentation along with online communities' assistance.
5.	Compare searching and visualization methodologies in Textual Documents, Database Querying, and Multimedia Documents.

Mapping of Course Outcomes with Program Outcomes:

Mapping		1	2	3	4	5	6	7	8	9	10	11	12	Pso1	Pso2
CO	1	3					1	1	1	2	2	1	1	1	
	2	3					1	1	1	2	2		1		
	3	2	3				1	1	1	2	2	1	1	1	
	4	2	3				1	1					1		
	5	1	2	2	3			1					1		

SYLLABUS

UNIT I: **12 -14 Hours**

Introduction: Usability of Interactive Systems- introduction, usability goals and measures, usability motivations, universal usability, goals for our profession.

Managing Design Processes: Introduction, Organizational design to support usability, Four pillars of design, development methodologies, Ethnographic observation, Participatory design, Scenario Development, Social impact statement for early design review, legal issues, Usability Testing and Laboratories.

UNIT II: **16-18 Hours**

Menu Selection, Form Fill-In and Dialog Boxes: Introduction, Task- Related Menu Organization, Single menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, Data entry with Menus: Form Fill-in, dialog Boxes, and alternatives, Audio Menus and menus for Small Displays.

Command and Natural Languages: Introduction, Command organization Functionality, Strategies and Structure, Naming and Abbreviations, Natural Language in Computing

Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory Interfaces, Displays- Small and large.

UNIT III: **14-16 Hours**

Quality of Service: Introduction, Models of Response-Time impacts, Expectations and attitudes, User Productivity, Variability in Response Time, Frustrating Experiences

Balancing Function and Fashion: Introduction, Error Messages, Non anthropomorphic Design, Display Design, Web Page Design, Window Design, Color.

UNIT IV: **7-9 Hours**

User Documentation and Online Help: Introduction, Online Vs Paper Documentation, Reading from paper Vs from Displays, Shaping the content of the Documentation, Accessing the Documentation, Online tutorials and animated documentation, Online communities for User Assistance, The Development Process.

UNIT V: **7-9 Hours**

Information Search: Introduction, Searching in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Searching Interfaces Information Visualization: Introduction, Data Type by Task Taxonomy, Challenges for Information Visualization

Text Books:

1. Designing the User Interface, Strategies for Effective Human Computer Interaction, 5ed, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven M Jacobs, Pearson
2. The Essential guide to user interface design,2/e, Wilbert O Galitz, Wiley DreamaTech.

Reference Books :

1. Human Computer, Interaction Dan R.Olsan, Cengage,2010.
2. Designing the user interface. 4/e, Ben Shneidermann , PEA.
3. User Interface Design, SorenLauesen ,PEA.
4. Interaction Design PRECE, ROGERS, SHARPS, Wiley.

Web Resources:

- https://onlinecourses.nptel.ac.in/noc18_cs23/preview

PROFESSIONAL ELECTIVE – II

PATTERN RECOGNITION	
CSE 414(E)	**Credits : 3**
Instruction **:** 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:
Basic Knowledge of statistics and probability theory.

Course Objectives:

- To make the students aware of pattern recognition techniques,
- To enable the students to develop pattern classification methodologies.

Course Outcomes
By the end of the course, the student will be able to:

1. Apply pattern recognition techniques, simple pattern classifiers and discriminate functions for a normal density.
2. Analyze the statistical bases of the classification theory
3. Analyze segmentation using non parametric techniques and linear discriminate functions.
4. Evaluate multi layer neural networks components, operations and algorithms.
5. Apply stochastic methods and non metric methods on real world problems.

Mapping of Course Outcomes with Program Outcomes:

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	1	2		1	1						1	1		1
CO 2	2	3	1	2	1								1	2
CO 3		2		2	2				1		1			3
CO 4	2	2	1	1	1				2		1	1		3
CO 5	3	3	2	3	3				3		3		1	3

SYLLABUS

UNIT-I: **10 periods**
Introduction:
Pattern recognition systems, the design cycle, Learning and adaptation;

Bayesian Decision Theory:
Introduction, Minimum error rate classification, Classifiers, Discriminant functions, and Decision surfaces, The normal density, Discriminant functions for the normal density, Example. **UNIT-II:** **12 periods**

Maximum-Likelihood and Bayesian Parameter Estimation:
Maximum-Likelihood estimation, Bayesian estimation, Bayesian parameter estimation (Gaussian case), Bayesian parameter estimation, Problems of dimensionality, Component analysis and Discriminants.

Employability

Employablitiy

UNIT-III: 12 periods

Non-parametric Techniques:

Density estimation, Parzen windows, *k*-nearest neighbor estimation, The nearest neighbor rule;

Employability

Linear discriminant functions:

Linear discriminant functions and decision surfaces, Generalized linear discriminant functions, The two-category linearly separable case, The descent algorithm, Minimum squared-error procedure with example, The Ho-Kashyap procedures.

UNIT-IV: 12 periods

Multilayer neural networks:

Introduction, Feed-forward operation and classification, Back propagation algorithm, Error surfaces, Representation at the hidden layer.

UNIT-V: 12 periods

Stochastic methods:

Introduction, Stochastic search, Boltzmann learning, Evolutionary methods, Genetic programming;

Non-metric methods:

Introduction, decision tree, CART, ID3, C4.5.

Employability

Text Books:

1. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification (2nd ed) John Wiley & Sons, 2006.

Reference Books :

1. Theodoridis and K. Koutroumbas, Pattern Recogniton , 4th edition, Academic Publishers, 2009;
2. R. Shighal, Pattern Recognition: Techniques and Applications, Oxford University Press, 1st edition, 2006.

Web Resources:

1. http://nptel.ac.in/courses/117108048/

PROFESSIONAL ELECTIVE – I (for CSE Students)

COMPUTER VISION	
CSE 415(A)	**Credits : 3**
Instruction **:** 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3Hours	End Exam Marks : 60

Prerequisites:
Basic Knowledge of computer graphics and image processing.

Course Objectives:

- To understand light and shading effects
- To understand filtering and texture techniques
- To understand the use of clustering techniques & models for segmentation
- To understand fitting techniques

Course Outcomes:
Upon completion of the course, the students will be able to

By the end of the course, the student will be able to:	
1.	Summarize the effect of radiometry in space and surface, Interpret local and global shading models and its effects.
2.	Identify appropriate linear filter mechanisms to enhance texture images
3.	Make use of clustering mechanisms in order to perform image segmentation.
4.	Apply fitting mechanisms on lines, curves and different shapes for image segmentation.
5.	Classify the images fitting using Class Histograms, Feature Selection, Neural Networks, Support Vector Machines.

Mapping of Course Outcomes with Program Outcomes:

Mapping		**PO**												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	**2**	**3**										**1**		
	2	**1**	**1**	**2**	**2**								**1**		
	3	**2**	**3**										**1**		**1**
	4	**1**	**1**	**2**							**1**		**1**		**1**
	5	**1**	**1**	**1**	**2**						**1**		**1**		**1**

SYLLABUS

UNIT-1 **12 PERIODS**

RADIOMETRY-MEASURING LIGHT: Light in Space, Light at Surfaces, Important Special Cases.

SOURCES, SHADOWS, AND SHADING: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Inter reflections: Global Shading Models.

UNIT-2 **12 PERIODS**

LINEAR FILTERS: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scale and Image Pyramids.

EDGE DETECTION: Noise, Estimating Derivatives, Detecting Edges.

TEXTURE: Representing Texture, Analysis using Oriented Pyramids, Application: Synthesizing Textures for Rendering, Shape for Texture for Planes.

UNIT-3 **12 PERIODS**

SEGMENTATION BY CLUSTERING: What is Segmentation, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering.

UNIT-4 **12 PERIODS**

SEGMENTATION BY FITTING A MODEL: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as Probabilistic Inference Problem, Robustness, Example: Using RANSAC to Fit Fundamental Matrices, Missing Data Problems, the EM Algorithm.

UNIT-5 **12 PERIODS**

FINDING TEMPLATES USING CLASSIFIERS: Method for Building Classifiers, Building Classifiers from Class Histograms, Feature Selection, Neural Networks, the Support Vector Machine.

Text Books:

TEXT BOOK:

1. David A.Forsyth, Jean Ponce, Computer Vision-A Modern Approach, PHI, 2003.

REFERENCES:

1. Geometric Computing With Clifford Algebras: Theoretical Foundations and Applications in Computer Vision and Robotics , Springer; 1/ e,2001 by Sommer.
2. Digital Image Processing and Computer Vision, 1/e, by Sonka.
3. Computer Vision and Applications: Concise Edition(With CD) by Jack, Academy Press, 2000.

Professional Elective III

CSE415(B)Embedded Systems	
CSE 415(B)	**Credits :**
Instruction **:** 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Basic Knowledge of Programming Fundamentals
Knowledge of Programming Languages (such as C, C++)

Course Objectives:

1.Find the basic components required to build an embedded system.
2.Select an appropriate software architecture to build an embedded system..
3.Design embedded software using RTOS.
4.Build embedded software using different software tools.
5.Debug embedded software using different software and hardware tools.

CO-PO mapping

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	3	1										1	1
CO-2	1	2	3										1	2
CO-3	1	2	3									1	1	1
CO-4	1	2	2	3	3							1	1	2
CO-5	1	1	2	3	3							1	1	2

SYLLABUS

UNIT I **12 PERIODS**

Introduction to embedded systems hardware needs, timing diagrams, memories (RAM, ROM, EPROM). Tristate devices, Buses, PLD’s, Built-ins on the microprocessor. Interrupts basics, ISR, Context saving, shared data problem. . Atomic and critical section. (8 Periods)

UNIT II 12 PERIODS

Survey of software architectures, Round Robin, Function queue scheduling architecture, Use of real time operating system. RTOS, Tasks , Scheduler, Shared data reentrancy, priority inversion, mutex binary semaphore and counting semaphore. (8 Periods)

UNIT III 12 PERIODS

Inter task communication, message queue, mailboxes and pipes, timer functions, events. Interrupt routines in an RTOS environment. Embedded system software design using an RTOS. Hard real time and soft real time system principles. Task division, need of interrupt routines, Interrupt latency Introduction to Device Drivers. (10 Periods)

Employability

UNIT IV 12 PERIODS

Embedded Software development tools. Host and target systems, cross compilers, linkers, locators for embedded systems. Getting embedded software in to the target system. (9 Periods)

Employability

UNIT V 12 PERIODS

Debugging techniques. Testing on host machine, ,Instruction set emulators, logic analysers. In-circuit emulators and monitors.

Employability

Case Study

DEVELOPING EMBEDDED C APPLICATIONS THROUGH KEIL SOFTWARE, Embedded PROGRAMMING IN C++, java (10 Periods)

Employability

Text Books:

1. David A. Simon, An Embedded Software Primer, Pearson Education, Inc.,1999
2. Raj Kamal, Embedded Systems, Architecture, Programming and Design, TMH, 2003

Reference Books:

1. Sriram V Iyer and Pankaj Gupta, Embedded Real Time

Systems programming, TMH, 2004.

2. Embedded C by M J Pont.

DATA WARE HOUSING & DATA MINING	
CSE415(C)	Credits : 4
Instruction : 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Before proceeding with this course, Student should have an understanding of the basic database concepts such as schema, ER model, Structured Query language and a basic knowledge of Data Warehousing concepts

Course Objectives:

1. The basics and challenges issues in Data Mining
2. The concepts of data warehouse and data mining
3. The tools and techniques used for Knowledge Discovery in Databases
4. The Potential and Current research issues in DataMining

Course Outcomes

By the end of the course, the student will be able to:

1. Extend the basics, challenging issues in Data Mining data warehousing and OLTP technologies.
2. Focus on data pre-processing approaches and data mining primitives, language, system architecture.
3. Analyze data generalization, summarization-based characterization; attribute relevance analysis in concept description. Analyze association rule mining in large databases.
4. Illustrate classification by using decision tree induction, Bayesian , back propagation and prediction methods.
5. Interpret categorization of major clustering methods.

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	2		1									1	1
	2	2	3	2	2	1	1		1	2	1	2	1	2	1
	3	2	3	2	2	2	2	1	1	1	1	2	2	3	
	4	2	3	1	1	1	1	1	1	2	2	2	3	3	1
	5	2	3	1	1	2	2	1	1	1	1	1	3	3	1

SYLLABUS

UNIT-1: **14 Periods**

Introduction to Data Mining: Motivation and importance, what is Data Mining, Relational Databases, Data Warehouses, Transactional Databases, Advanced Database Systems and Advanced Database Applications, Data Mining Functionalities, Interestingness of a pattern Classification of Data Mining Systems, Major issues in Data Mining.

Data Warehouse and OLAP Technology for Data Mining: What is a Data Warehouse? Multi-Dimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Development of Data Cube Technology, Data Warehousing to Data Mining.

UNIT-II: **10 Periods**

Data Pre-processing: Why Pre-process the Data? Data Cleaning, Data Integration and Transformation Data Reduction, Discretization and Concept Hierarchy Generation

Data Mining Primitives, Languages and system Architectures, Data Mining Primitives: Data Mining Task, A Data Mining query language, Designing Graphical User Interfaces Based on a Data Mining Query language, Architectures of Data Mining Systems.

UNIT-III: 14 Periods

Concept Description: Characterization and comparison, what is Concept Description? Data Generalization and summarization-based Characterization, Analytical Characterization: Analysis of Attribute Relevance, Mining Class Comparisons: Discriminating between different Classes, Mining Descriptive Statistical Measures in large Databases.

Mining Association rule in large Databases: Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-Based Association Mining

UNIT-IV: 14 Periods

Classification and prediction: Concepts and Issues regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back-propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods like k-Nearest Neighbor Classifiers, Case- Based Reasoning, Generic Algorithms, Rough Set Approach, Fuzzy Set Approaches, Prediction, Classifier Accuracy

UNIT-V: 12 Periods

Cluster Analysis: What is Cluster Analysis? Types of Data in Cluster Analysis, a Categorization of Major Clustering Methods

Text Book:

1. Data Mining Concepts and Techniques, Jiawei Han and MichelineKamber, Morgan Kaufman Publications

Reference Books:

1. Introduction to Data Mining, Adriaan, Addison Wesley Publication
2. Data Mining Techniques, A.K.Pujari, University Press

Web Resources:

1. http://nptel.ac.in/syllabus/106106046/
2. http://nptel.ac.in/courses/106106093/35

Machine Learning	
CSE 415(D)	**Credits : 4**
Instruction **:** 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Concept of statistics and probability

Course Objectives:

1. Students will understand the basic concepts of Machine Learning, in particular focusing on the core concepts of supervised and unsupervised learning.
2. Students will learn the algorithms which underpin many popular Machine Learning techniques,
3. Students can acquire the knowledge in developing an understanding of the theoretical relationships between these algorithms

Course Outcomes:By the end of the course, the student will be able to:

1. Demonstrate well posed machine learning problems and examine Find-s, version space and candidate elimination algorithm.
2. Construct and analyze the problems and issues of decision tree learning algorithm.
3. Apply Bayes theorem, concept learning, maximum likelihood, least squared error hypothesis for classification of text data.
4. Illustrate neural network representation, problems of neural networks and back propagation algorithm
5. Determine nearest neighborhood learning and locally weighted regression. Illustrate optimization problems using genetic algorithms.

Mapping of Course Outcomes with Program Outcomes:

Mapping		**PO**												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	1	2	1		1				1	1					1
	2	2	2	3	3		1			2	1	1	1		
	3	2	2	1	2		2	1	1	1	2		2	3	1
	4	2	3	1	1	2	1	2	1	1	1	1	1	3	1
	5	2	3	1	1	2	2	1	1	1	1	1	2	3	1

Syllabus

UNIT-I:

Introduction: **12 PERIODS**

Well-posed learning problems, Types of machine learning, designing a learning system, Perspectives and issues in machine learning. A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Inductive Bias

UNIT II:

Decision Tree learning: **12 PERIODS**

Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis Space search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in decision tree learning

Skill set

UNIT III:

Bayesian learning **12 PERIODS**

Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Bayes optimal classifier, Naïve bayes classifier, An example learning to classify text,

Employablitiy

UNIT IV:

Artificial Neural Networks **12 PERIODS**

Introduction, neural network representation, problems for neural network learning, perceptron , Multilayer networks and back propagation algorithm

UNIT V: Employability 12 PERIODS

Instance based Learning

Nearest neighborhood learning, Locally weighted regression

Genetic Algorithm

Motivation ,Representing Hypothesis, Genetic operators, Fitness function and selection ,An Illustrative Example

TEXT BOOK: Employability

1. Machine Learning ,Tom M. Mitchell,MGH,1997

REFERENCE BOOK:

1. Machine Learning, An Algorithmic Perspective, Stephen Marsland, Taylor&Francis (CRC)
2. Introduction to Machine Learning, EthemAlpaydin, PHI,2004.

PROFESSIONAL ELECTIVE – III

CYBER SECURITY	
CSE415(E)	**Credits : 4**
Instruction **:** 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:
Basic Knowledge of Data Communications, Computer Networks
Knowledge of Operating Systems Windows, Linux and Programming Languages (C, C++)

Course Objectives:

- Introducing Cyber Security Concepts
- Giving basic exposure about Cyber Crimes
- Explaining tools used in Cyber Crimes
- Explaining Cyber Law present in the system.

Course Outcomes: By the end of the course, the student will be able to:

1. Explain about vulnerability scanning approaches and describe the functionality of different types of scanning and service tools.
2. Comprehend about networking layers and summarize the defense methodologies and its relevant tools functionality.
3. Describe and inspect web vulnerabilities through Zed Attack Proxy, Sqlmap. DVWA, Webgoat and password cracking mechanisms.
4. Comprehend the cybercrime scenario and recognize the appropriate cyber law.
5. Demonstrate the cybercrime scenario and solve the crime through investigation by applying ethical hacking mechanisms.

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	2										1		
	2	1	2										1		
	3	1	2	3									1		
	4		2										1		
	5	1	1	2	3						1		1		

Employability

SYLLABUS

UNIT-I: Systems Vulnerability Scanning 12 periods

Overview of vulnerability scanning, Open Port / Service Identification, Banner /Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet

Employability

UNIT-II: Network Defense tools 12 periods

Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless VsStateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System

Employability

UNIT-III: Web Application Tools 10 periods

Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra

Employability

UNIT-IV: Introduction to Cyber Crime and law 12 period

Employability

Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.

UNIT-V: Introduction to Cyber Crime Investigation and Ethical Hacking 12 periods

Firewalls and Packet Filters, password Cracking, Key loggers and Spyware, Virus and Warms, Trojan and backdoors, Stegnography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks

Employability

Text Books:

1.Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication McGraw Hill. 2.Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and SunitBelpure, Publication Wiley

Reference Books :

1. The Complete Reference Network Security By Robert Bragg,Mark Rhodes-Ousley,KeithStrassberg, 1st Edition,McGraw Hill India (2004) Publication

Web Resources:

1) https://www.coursera.org/specializations/cyber-security

2) https://computersecurity.stanford.edu/

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CRYPTOGRAPHY & NETWORK SECURITY LAB	
CSE 416	**Credits : 2**
Instruction : 3 Hrlab/Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Prerequisites:

Basic knowledge of Computer Networks
Exposure to Problem solving techniques and programming skills

Course Objectives:

- Introducing different tools related to Network Security.
- Introducing how to implement cryptographic algorithms in C/C++/Java.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Demonstrate the process of capturing Network traffic using tools(Ethereal,Wireshark,Tcpdump)
2.	Implement Cryptographic algorithms in C/C++/Java
3.	Build Secure communication channel for web communication.
4	Use tools nmap and IPtables for network security.

Mapping of course outcomes with program outcomes:

Mapping		PO												PS O	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1		1	1	2	3			2	3			1	1	1
	2	1	2	3	3					2	3		1	1	2
	3		2	3						2	3		1	1	1
	4		2	2	3	3				2	3		1	1	2

SYLLABUS

LIST OF EXPERIMENTS:

1. Working with Sniffers for monitoring network communication using a)Ethereal b)Wireshark c) Snort d) tcpdump
Employability Skill
2. Implementation and Performance evaluation of various cryptographic algorithms in C/C++ a)DES b)RSA
Employability Skill
3. Using IP TABLES on Linux and setting the filtering rules
4. Using open SSL for web server - browser communication
5. Configuring S/MIME for e-mail communication
6. Understanding the buffer overflow and format string attacks
Employability Skill
7. Using NMAP for ports monitoring
8. Secure Socket programming.

Case studies:

Employability Skill

9. Study of GNU PGP.
10. Study Intrusion Detection Systems and Honey pots.

Text Books :

1)The Complete Reference Network Security By Robert Bragg,Mark Rhodes-Ousley,KeithStrassberg, 1st Edition,McGraw Hill India (2004)Publication

2) The Unofficial Guide to Ethical Hacking by byAnkitFadia ,Second edition(2006),Laxmi Publications.

3) Network Security Tools Writing, Hacking, and Modifying Security Tools by NiteshDhanjani, Justin Clarke, 2013 Edition, Publisher: O'Reilly Media.

4) Linux and UNIX Security Portable Reference Book by Nitesh Dhanjani,1stEdition,McGraw-Hill.

Reference Books:

1)Network Security Tools Writing, Hacking, and Modifying Security Tools By NiteshDhanjani, Justin Clarke,2nd Edition, Publisher: O'Reilly Media

Web Resources:

1) https://www.udemy.com/courses/it-and-software/network-and-security/
2) https://online.stanford.edu/course/network-security

PROFESSIONAL ELECTIVE – IV

CLIENT SERVER COMPUTING	
CSE 421(A)	**Credits : 4**
Instruction **:** 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:
Fundamentals of Computer Networks and networking protocols.Fundamentals of Operating systems.
Fundamentals of Data bases and storage devices.

Course Objectives:

- Understand client/ server computing environment.
- Understand the network architecture of client/ server computing.
- Know the design aspects of the administrator of client/ server architecture.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Fundamental understanding of client server computing.
2.	Describe the components of client/ server applications.
3.	Analyze the client/ server network.
4.	Understand the developments of client/ server systems.
5.	Analyze the roles and responsibilities of server and database administrator.

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	2									2	2		
	2	2	2									2	2		
	3			3		1						1	1		
	4	2	2									2	2		
	5						2		2	2			2		

SYLLABUS

UNIT-I: **12 periods**

Client/Server Computing: DBMS concept and architecture, Single system image, Client Server architecture, mainframe-centric client server computing, downsizing and client server computing, preserving mainframe applications investment through porting, client server development tools, advantages of client server computing.

Employability

UNIT-II: **12 periods**

Components of Client/Server application: The client: services, request for services, RPC, windows services, fax, print services, remote boot services, other remote services, Utility Services & Other Services, Dynamic Data Exchange (DDE), Object Linking and Embedding (OLE), Common Object Request Broker Architecture (CORBA). The server: Detailed server functionality, the network operating system, available platforms, the network operating system, available platform, the server operating system

Employability

UNIT-III: **10 periods**

Client/Server Network: connectivity, communication interface technology, Interposes communication, wide area network technologies, network topologies (Token Ring, Ethernet, FDDI, CDDI) network management, Client-server system development: Software, Client–Server System Hardware: Network Acquisition, PC-level processing unit, Macintosh, notebooks, pen, UNIX workstation, x-terminals, server hardware.

UNIT-IV: **12 periods**

Client Server Systems Development: Services and Support, system administration, Availability, Reliability, Serviceability, Software Distribution, Performance, Network management, Help Disk, Remote Systems Management Security, LAN and Network Management issues.

Employability

UNIT-V: **12 periods**

Client/Server System Development: Training, Training advantages of GUI Application, System Administrator training, Database Administrator training, End-user training. The future of client server Computing Enabling Technologies, The transformational system.

Employability

Text Books:

2. Patrick Smith &SteaveGuengerich, "Client / Server Computing", PHI Learning Private Limited, DelhiIndia.

Reference Books :

2. Dawna Travis Dewire, "Client/Server Computing", Tata Mcgraw-hill Education Pvt. Ltd.
3. Majumdar& Bhattacharya, "Database management System", Tata Mcgraw-hill Education Pvt.Ltd.
4. Korth, Silberchatz, Sudarshan, "Database Concepts", Tata Mcgraw-hill Education Pvt. Ltd.
5. Elmasri, Navathe, S.B, "Fundamentals of Data Base System", Addison Wesley

Web Resources:

1. http://www.nptelvideos.com/video.php?id=1472
2. http://nptel.ac.in/courses/106105087/41

Augmented Reality	
CSE 421(B)	**Credits : 4**
Instruction **:** 4 Inst.& 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Basic knowledge on C and C++
Basic knowledge on computer graphics
Basic mathematical knowledge

Course Objectives:

- To make the candidate understand the importance of augmented reality and its future as an aiding tool
- To check out various hardware and software components for augmented reality applications.
- Learn to build different types of objects that can act as contents for augmented reality.
- To understand various application like of augmented reality and build a small application that works on AR Marker or QR Code.

COURSE OUTCOMES:

CO1- Will be able to understand augmented reality and its future as an aiding tool
CO2- Will be able to know and use different hardware and software components to build an augmented reality application
CO3- Will be able to design 3D or 2D objects that can act as contents for augmented reality application and also to make these objects interact with the real world.
CO4- Will be able to build a small mobile augmented reality app that works on AR Marker.
CO5- Will be able understand various application for augmented reality and work on those application areas

Mapping of Course Outcomes with Program Outcomes:

Mapping		**PO**												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	**1**					**2**	**2**		**1**			**2**	**1**	**3**
	2	**2**		**3**	**3**	**3**	**1**			**2**		**1**	**1**		**3**
	3	**3**		**2**	**1**	**3**						**1**			**3**
	4	**2**	**2**	**2**	**2**	**3**				**1**			**2**		**3**
	5	**3**		**3**	**2**	**1**							**1**		**3**

SYLLABUS

Unit 1 **10 hours**

Argument that reality: Introduction, origins of augmented reality, explanation of augmented reality with different scenarios, relationship between augmented reality and other technologies.

Augmented reality concepts: Introduction, how does augmented reality work, concepts related to augmented reality, ingredients of an argument reality experience.

Employability

Unit 2 **14 hours**

Augmented reality hardware and software: Introduction, major hardware components for argument a reality systems, major software components for argument that reality systems, software is used to create content for augmented reality applications. Employab

Unit 3 **12 hours**

Augmented reality content and interaction in Augmented reality: what is content, creating visual content like 3-D dimensional objects and today dimensional images, interaction in the real world, Manipulation, navigation.

Unit 4 **10 hours**

Mobile augmented reality: Introduction, what is mobile augmented reality, advantages and disadvantages of mobile augmented reality. Employabili

Unit 5 **12 hours**

Augmented reality applications: Introduction, what makes a good documented reality application, application areas.

TEXT BOOKS:

T1. Understanding Augmented Reality – Concepts and Applications by Alan B Craig, Elsevier Publications

REFERENCES BOOKS:

R1. Augmented Reality – An Emerging Technologies Guide to AR by Gregory Kipper, Elsevier Publications.

SEMANTIC WEB	
CSE 421(C)	**Credits : 4**
Instruction **:** 4 Inst.& 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Basic knowledge on java
Basic knowledge on web technologies
Basic mathematical knowledge

Course Objectives:

- To make the student understand the importance of semantic web and its role in making the web intelligent.
- To learn various concepts of semantic web like ontologies, RDF, RDF schema and OWL.
- ➢ Learn to build an ontology model for semantic web using different tools like protégé, jena ontology framework etc.,
- To understand various applications like software agents and semantic desktop

COURSE OUTCOMES:

CO1- Will be able to understand the semantic web as the future of the web and its importance
CO2- Will be able to understand and differentiate between taxonomies, thesauri and ontologies along with gaining knowledge on rules for building ontologies.
CO3- Will be able to describe a resource using RDF format along with working on RDF schema and OWL. And also developing the inference rules using rule languages.
CO4- Will be able to build an ontology model using the tools like protégé, Jena ontology framework.
CO5- Will be able to develop a small application of semantic web like a semantic desktop with limited functionality.

Mapping of Course Outcomes with Program Outcomes:

Mapping		**PO**												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	**1**					**2**	**2**		**1**			**2**	**1**	**3**
	2	**2**				**2**	**1**			**2**		**1**	**1**		**3**
	3	**3**		**2**		**1**						**1**			**3**
	4	**2**	**2**	**2**	**2**	**3**				**1**			**2**		**3**
	5	**3**		**3**	**2**	**1**							**1**		**3**

Course Contents:

UNIT 1 **10 Hours**

Introduction to semantic Web: the syntactic web, the semantic Web, how was the semantic Web will work, what the semantic Web is not, what will be the side effects of the semantic Web.

UNIT 2 **10 Hours**

Introduction to ontology in computer science: defining the term ontology, differences among taxonomies, thesauri and ontologies, classifying ontologies, web ontology description languages.

Knowledge representation in description logic: introduction, and informal example, the family of attributive languages, inference problems.

EMPLOYABILITY

UNIT 3 **14 Hours**

RDF and RDF schema: introduction, XML essentials, RDF, RDF schema and its vocabulary.

OWL: introduction, requirements for web ontology description language, header information versioning and annotation properties, properties, classes, individuals, data types.

Rule languages: introduction, usage scenarios for rule language, datalog, ruleml, swirl, triple.

UNIT 4 EMPLOYABILITY **12 Hours**

Methods for ontology development: introduction, Uschold and King ontology development method, Toronto virtual enterprise method, methontology, lexicon based ontology development method.

Ontology sources: introduction, metadata, upper ontologies.

Semantic Web software tools: introduction meta data and ontology editors like Dublin core metadata editor, OliEd, protégé ontology editor.

EMPLOYABILITY

UNIT 5 **12 Hours**

Software agents: introduction, agent forms, agent architecture, agents in semantic Web context.

Semantic desktop: introduction, semantic desktop metadata, semantic desktop ontologies, semantic desktop architecture, semantic desktop related applications

TEXT BOOKS:

T1. SemanticWeb – Concepts, Technologies and Applications by Karin K Breitman, Springer

REFERENCES BOOKS:

R1. A Semantic Web Premier by Grigoris Antoniou, 2nd edition, MIT Press

PROFESSIONAL ELECTIVE – IV

BIG DATA ANALYTICS	
CSE 421(D)	**Credits : 3**
Instruction **:** 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:
Basic Knowledge of statistics and probability theory,
Basic knowledge of databases.

Course Objectives:

- To make the students aware of pattern recognition techniques,
- To enable the students to develop pattern classification methodologies.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	know fundamental basis of big data,
2.	know the modern storage concepts and devices for storing big data,
3.	know big data processing algorithms,
4.	be able to handle and analyze business data,
5.	develop methods for business data analysis.

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		A	B	C	D	E	F	G	H	I	J	K	L	1	2
CO	1	1	2	0	1	1				2		1	1		1
	2	2	2		2	1	2			1		1	1	1	2
	3		2		2	2				1		1	1		3
	4	1	2		1	1				2		1	1		3
	5	3	3	2	2	2				2		1		1	3

SYLLABUS

UNIT-I: **10 periods**

Introduction:
Understanding big data, Concepts and terminologies, Characteristics, Types, Case study background and example, Business architecture and process management, Information and communication technology (ICT).

Adoption and Planning considerations:
Organization prerequisites, data procurement, privacy, security, provenance, data analytics life cycle, case study example.

UNIT-II: **12 periods**

Enterprise technologies and Big data business intelligence:
Online transaction processing (OLTP), Online analytical processing (OLAP), Extract transform load (ETL), Data warehouses, Data marts, traditional business intelligence, Big data business intelligence, Case study examples of business enterprise and big data business intelligence.

EMPLOYABILITY

UNIT-III: **12 periods**

Storing and Analysis process:

Clusters, File systems and distributed file systems, NoSQL, Sharding and replication, CAP theorem, ACID, BASE, Case study example;

Processing concepts:

Parallel and distributed data processing, Hadoop, processing workloads, clusters, Map reduce, case study example.

EMPLOYABILITY

UNIT-IV: **10 periods**

Storage technology:

On-disk storage devices, NoSQL databases, In-memory storage devices, Case study example.

UNIT-V: **14 periods**

Big data analysis techniques:

Quantitative and qualitative analysis, data mining, statistical analysis, machine learning, semantic analysis, visual analysis, case study example.

EMPLOYABILITY

EMPLOYABILITY

Text Books:

1. Thomas Erl, WajidKhattak, and Paul Buhler, "Big Data Fundamentals Concepts, Drivers & Techniques", Prentice Hall Service Technology.

.

Reference Books :

3. ArshdeepBahga , Vijay Madisetti, " *Big Data Science & Analytics: A Hands-On Approach* ", April 15, 2016, Copyrighted material.

Web Resources:

1. http://nptel.ac.in/noc/individual_course.php?id=noc17-mg24
2. https://www.coursera.org/specializations/big-data

PROFESSIONAL ELECTIVE – IV

INFORMATION SECURITY AND AUDITING	
CSE 421(E)	**Credits : 4**
Instruction **: 4** Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:
Computer Networks
Cryptography and Network Security

Course Objectives:

- Knowbasic information security concepts and attacking techniques.
- Have knowledge on common security policies, cryptographic tools.
- Basic knowledge on security at software and operating systems level.
- Gain knowledge on legal and ethical issues in information security systems.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Understand the basic concepts and general techniques in intrusion detection.
2.	Understand overflow attacks and learn to write safe program code.
3.	Describe basic concepts and general techniques in establishing security and audit in IT Infrastructure.
4.	Describe basic concepts and general techniques in risk assessment, handling legal and ethical issues.
5.	Understand internet protocol security and standards and operating system security.

Mapping of Course Outcomes with Program Outcomes:

	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		2		1		2	1		1	1		1		1
CO2	2	1	1	2	2	1		2	1	2			1	1
CO3		1	2	2	2	1		1	2	1	1	1	1	
CO4		1	2	3	2	1		1	2	1	1	1	1	
CO5	2	2		2	2	1			2	2	2	1	1	

SYLLABUS

UNIT-I: **12 periods**

Overview: Computer security concepts, threats, attacks and assets, security functional requirements, security architecture for open systems, scope of computer security, computer security trends and strategy.

Computer Security Technology and Principles:

(Cover fundamentals of Cryptographic tools, authentication, access control.)

Intrusion Detection:

Intruders, intrusion detection, intrusion detection systems- host-based, distributed host-based, network-based, distributed adaptive intrusion detection, intrusion detection exchange format, honey pots, example system: Snort.

EMPLOYABILITY

UNIT-II: **12 periods**

Firewalls and Intrusion Prevention Systems: Need for firewalls, firewall characteristics, types of firewalls, firewall basing, firewall locations and configurations, intrusion prevention systems.

Software Security: Buffer Overflow-stack overflow, defending against buffer overflows, other forms of overflow attacks, software security issues, handling program input, writing safe program code, interacting with operating systems and other programs.

EMPLOYABILITY

UNIT-III: **10 periods**

Management Issues: Physical and Infrastructure Security- overview, threats, prevention and mitigation methods, recovery from security breaches, threat assessment, planning and plan implementation, A Corporate Physical Security Policy-an example, integration of physical and logical security. Human Factors- Security awareness, training and education, organizational security policy, employment practices and policies, e-mail and internet use policies, A Corporate Security Policy Document-an example. Security Auditing- security auditing architecture, auditing trail, implementing logging function, audit trail analysis, An Integrated Approach-an example.

EMPLOYABILITY

EMPLOYABILITY

UNIT-IV: **12 periods**

Management Issues:IT Security Management and Risk Assessment-IT Security Management, organizational context and security policy, security risk assessment and analysis, Case Study: Silver Star Mines. IT Security Control Plans and Procedures- IT Security Management and implementation, safeguards, IT Security plan, implementation of controls and follow up, Case Study: Silver Star Mines. Legal and Ethical Aspects- cybercrime and computer crime, intellectual property, privacy, ethicalissues.

UNIT-V: **12 periods**

Internet security protocols and standards: secure sockets layer, transport layer security, IPv4and IPv6 security, secure mail and S/ MIME.Internet Authentication Applications: Kerberos, X.509, public key infrastructure, federal identity management.

EMPLOYABILITY

Operating System Security:

Linux Security: Linux's security model, file system security, Linux vulnerabilities, Linux system hardening, application security, mandatory access controls.
Windows and Windows Vista security: Windows security architecture, windows vulnerabilities, windows security defenses, browser defenses, cryptographic services.

EMPLOYABILITY

EMPLOYABILITY

Text Books:

1. W. Stallings, "Computer Security: Principles and Practice," 2nd Edition, Prentice Hall, ISBN: 0132775069, 2011.

Reference Books :

1. M. Stamp, "Information Security: Principles and Practice," 2nd Edition, Wiley, ISBN: 0470626399, 2011.

2. M. E. Whitman and H. J. Mattord, “Principles of Information Security,” 4th Edition, Course Technology, ISBN: 1111138214,2011.
3. M. Bishop, “Computer Security: Art and Science,” Addison Wesley, ISBN: 0-201-44099-7, 2002.
4. G. McGraw, “Software Security: Building Security In,” Addison Wesley, ISBN: 0321356705, 2006.Krishna, *”Object Oriented Programming through Java*”, Universities Press.

Web Resources:

1. https://www.coursera.org/learn/enterprise-infrastructure-security
2. https://www.coursera.org/learn/secure-networked-system-with-firewall-ids
3. https://www.coursera.org/learn/planning-auditing-maintaining-enterprise-systems
4. https://www.coursera.org/learn/software-security

SOCIAL NETWORK ANALYSIS	
CSE 421(F)	**Credits : 3**
Instruction **:** 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Basic Knowledge of Data structures& Algorithms, Computer Networks and Data communication

Course Objectives:

- To understand the functionality of a social network.
- To model and visualize the social network.
- To mine the users in the social network.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Work on the internal components of the social network.
2.	Model and visualize the social network.
3.	Mine the behavior of the users in the social network.
4.	Analyze the opinion of the user.
5.	Predict security and privacy issues in real social networking sites.

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1													
	2		2	2	1					1				1	
	3	1	2	2						1				1	2
	4		2	2						1				1	2
	5					3									2

SYLLABUS

UNIT-I: **12 periods**

Introduction: Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

EMPLOYABILITY

UNIT-II: **12 periods**

Modeling And Visualization: Visualizing Online Social Networks - A Taxonomy of 26 Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

EMPLOYABILITY

EMPLOYABILITY

UNIT-III: **12 periods**

Mining Communities: Aggregating and reasoning with social network data- Advanced Representations - Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

EMPLOYABILITY

UNIT-IV: **12 periods**

Text and Opinion Mining: Text Mining in Social Networks -Opinion extraction – Sentiment classification and clustering - Temporal sentiment analysis - Irony detection in opinion mining - Wish analysis - Product review mining – Review Classification – Tracking sentiments towards topics over time.

EMPLOYABILITY

UNIT-V: **12 periods**

Privacy in online social networks: Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

Tools: Gephi, Palladio, NodeXL

EMPLOYABILITY

Text Books:

1. Peter Mika, “Social Networks and the Semantic Web”, 1st edition, Springer,2007.
2. BorkoFurht, “Handbook of Social Network Technologies and Applications”, 1stedition, Springer, 2010

Reference Books :

1. Charu C. Aggarwal, “Social Network Data Analytics”, Springer; 2011.
2. GuandongXu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, 1st edition, Springer,2011.
3. Giles, Mark Smith, John Yen, “Advances in Social Network Mining and Analysis”, Springer, 2010.
4. Ajith Abraham, Aboul Ella Hassanien, VáclavSnáel, “Computational Social Network Analysis: Trends, Tools and Research Advances”, Springer, 2009.
5. Toby Segaran, “Programming Collective Intelligence”, O’Reilly, 2012.
6. SuleGündüz-Ogüdücü, A. ŞimaEtaner-Uyar, “Social Networks: Analysis and Case Studies”, Springer, 2014

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc16_cs07/preview
2. https://gephi.org/
3. https://sites.google.com/a/umn.edu/social-network-analysis/home

PROFESSIONAL ELECTIVE – V 4/4 CSE Students

NETWORK MANAGEMENT	
CSE 422(A)	**Credits : 3**
Instruction **:** 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Basic Knowledge of Networking Fundamentals
Basic Knowledge of protocols.

Course Objectives:

- To understand the principles of network management, different standards and protocols used in managing complex networks.
- To understand the Automation of network management operations and making use of readily available network management systems.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Acquire the knowledge about network management standards (OSI and TCP/IP)
2.	Acquire the knowledge about various network management tools and acquire the skill to use them in monitoring a network
3.	Analyse the challenges faced by Network managers
4.	Evaluate various commercial network management systems and open network management systems.
5.	Analyse and interpret the data provided by an NMS and take suitable actions

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	3	3										2	1
	2		2	2	2									2	
	3		3	3		2								1	
	4				2	2								1	
	5		3	3		3								1	1

SYLLABUS

UNIT - I **10 HOURS**

Data communications and Network Management Overview : Analogy of Telephone Network Management, Communications protocols and Standards, Case Histories of Networking and Management, Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.

Employability Skill

UNIT - II **15 HOURS**

SNMPV1 Network Management: Organization and Information and Information Models. Managed network : Case Histories and Examples, The History of SNMP Management, The SNMP Model, The Organization Model, System Overview, The Information Model.

SNMPv1 Network Management: Communication and Functional Models. The SNMP Communication Model, Functional model.

UNIT – III Employability Skill **10 HOURS**

SNMP Management: SNMPv2: Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility With SNMPv1.

UNIT - IV **15 HOURS**

SNMP Management: RMON : What is Remote Monitoring? , RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON

Employability Skill

UNIT – V **10 HOURS**

Network Management Tools and Systems: Network Management Tools, Network Statistics Measurement Systems, Network Management systems, Commercial Network management Systems, System Management, Enterprise Management Solutions. **Web-Based Management:** NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management,

Employability Skill

TEXT BOOK :

- Network Management, Principles and Practice, Mani Subrahmanian, Pearson Education.

REFERENCES :

1. Network management, Morris, Pearson Education.
2. Principles of Network System Administration, Mark Burges, Wiley Dreamtech.
3. Distributed Network Management, Paul, John Wiley.

WEB REFERENCES :

http://nptel.iitm.ac.in/courses/IIT-MADRAS/ Computer_Networks/

PROFESSIONAL ELECTIVE – V

FUZZY COMPUTING	
CSE 422(B)	**Credits : 3**
Instruction **:** 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:
Basic Knowledge of mathematical function and relation.Knowledge of set theory and logical operations.

Course Objectives:

- To understand Fuzzy logic and inference system.
- To learn automated method of learning.
- To be able to applydecision making and classification techniques.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Differentiate between Fuzzy sets and crisp sets and their relational operations.
2.	Apply Fuzzification and de-Fuzzification with different member functions.
3.	Implement different automated methods of learning.
4.	Do decision making while solving problems for engineering applications.
5.	Classify and recognition patterns of discriminative classes.

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		A	B	C	D	E	F	G	H	I	J	K	L	1	2
CO	1		2		1							1			1
	2	3	2		1					1		1		1	2
	3	2	3		1					2		1		2	3
	4	3	3		2					3		3		1	3
	5	3	3		3					3		3		1	2

SYLLABUS

UNIT-I: **10 periods**

Fuzzy systems:
Introduction, History, Utility, Limitations, Uncertainty, accuracy and information, Fuzzy set, Fuzzy membership, Sets in hypercube.

Fuzzy sets:
Function and mapping in classical sets, Crisp versus Fuzzy set, Operations on Fuzzy sets, Properties.

UNIT-II: **12 periods**

Crisp and Fuzzy Relations:
Cardinality and properties of crisp relations, Operations on crisp relations, Cardinality and properties of Fuzzy relations, Operations on Fuzzy relations, Fuzzy Cartesian product and composition, Crisp tolerance and equivalence relations, Fuzzy tolerance and equivalence relations, Value assignments, Cosine amplitude, Max–Min method, Other similarity methods.

UNIT-III: **12 periods**

Logic and Fuzzy System:

Membership function and it's features, Fuzzification and its types, Defuzzification, λ-cuts for Fuzzy relations, Defuzzification to Scalars, Classical logic, Proof,Fuzzy logic, Approximate reasoning, Other forms of the implication operation, Rule-based systems, Graphical techniques of inferences, Membership value assignments through intuition, inference, and rank ordering.

Employability

UNIT-IV: **08 periods**

Automated Methods:

Batch least squares algorithm, Recursive least squares algorithm, Gradient method, Clustering method, Learning from examples, Modified learning from examples.

Employability

UNIT-V: **14 periods**

Decision Making:

Synthetic evaluation, Ordering, Non-transitive ranking, Preference and consensus, Multi-objective decision making.

Employability

Classification: Classifying by equivalence relations,Crisp relations and Fuzzy relations, Cluster analysis, Cluster validity, Hard c-Means (HCM) and Fuzzy c-Means (FCM), Fuzzy c-Means Algorithm.

Text Books:

4. Timothy J. Ross, "*Fuzzy Logic with Engineering Applications*", Third Edition, Wiley.

Reference Books :

10. S. Rajasekaran, G.A.V. Pai, *"Neural Network, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications",*PHI.

Web Resources:

1. http://nptel.ac.in/courses/106105173/2
2. http://nptel.ac.in/courses/108104049/16#

WIRELESS SENSOR NETWORKS	
CSE 422(C)	**Credits: 3**
Instruction: 3 Periods & 1Tut/ Week	Sessional Marks : 40
End Exam: 3Hours	End Exam Marks : 60

Prerequisites:

To Undertake this course student must have basic understanding of Computer Networks, Data Communications and Networking Technologies.
Prior knowledge of database and data strucutures

Course Objectives:

- To make students understand with the fundamentals and terminology of wireless sensor networks.
- To provide students a sound foundation of the wireless sensor networks so that they are able to design / propose the suitable network for the required application.
- Student will examine protocols and algorithms used to operate the wireless sensor network and will explore the challenges and research issues in the field of wireless sensor networks.

Course outcomes:

1. Memorizing the concepts and the need of wireless sensor networks.
2. Apply the infrastructure of the WSAN.
3. Analyse the routing protocols & algorithms to implement the wireless sensor networks.
4. Identify the challenges of wireless sensor networks.
5. Evaluating the problems of critical nodes and links.

Mapping of course outcomes with program outcomes:

Mapping		**PO**												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**
	2	**1**	**3**	**3**	**2**	**2**		**2**	**1**	**2**	**2**		**2**	**2**	**1**
	3	**2**	**3**	**2**	**3**	**2**		**1**	**1**	**2**	**2**		**2**	**2**	**2**
	4	**1**	**2**	**2**	**3**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**2**	**1**	**1**
	5	**2**	**3**	**3**	**2**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**2**

SYLLABUS

Unit – I : 10 Periods

Overview of Wireless sensor and actuator networks, comparison of adhoc network, infrastructure network and sensor networks. Introduction to wireless sensor Networks and wireless sensor actuator networks, Terminology WSN architecture, requirements and standards, Topologies uses in Wireless sensor and actuator network.

Unit–II: 10 Periods

Applications of wireless sensor networks and wireless sensor actuator networks, , what the challenges ,issues in wireless sensor actuator networks ?requirement for wireless sensor network deployment various standards for WSAN Development of sensor network. Overview of broadcasting techniques, backbone and broadcasting in sensor actuator networks, coverage and connectivity criteria.

EMPLOYABILITY

Unit- III: **10 Periods**

Placement and deployment of sensors in wireless sensor networks.Static sensors and mobile sensors placements.

Placement by Actuataros:- Least Recently Visited Approach, Snake like Deployment Approach, Back-Tracking-Deployment Approach EMPLOYABILITY

Different methods used for sensor placement and deployment, Issues with the wireless sensor network deployment

Sensor Self Depolyment Methods:-Virtual Force/Vector Based Approach, Voronoi Based Approach, Mobile Sensor Migration

EMPLOYABILITY

Unit – IV : **12 Periods**

Multicasting, multi rating casting, geocasting and any casting in sensor network,
Routing in Wireless Sensor and Actuator Networks :flooding, gossiping, classification of routing protocols, Study of types of routing protocols used in wireless sensor network. EMPLOYABILITY

Routing protocols based on network strucutures:- Flat networks routing – directed diffusion, SPIN, Rumor, GBR hierarchicial networks routing :- LEACH,PEGASIS,TEEN routing, location based routing :- Greedy, Face, Geographic adaptive fidelity, Geographic and energy aware routing.

Unit-V: **12 Periods**

Sink Mobility :- Data gathering in delay tolerant Wireless Sensor Networks : - Sink tour and RP based data collection methods : Direct contact data collection, Rendezvous based data collection, Introduction to sink mobility, energy problems EMPLOYABILITY

Topology Control in Sensor, Actuator : - use of MST and LMST , Introduction and detection of critical nodes and links : how to identify the critical nodes and links, how to solve the problem of critical nodes and critical links. EMPLOYABILITY

Text Book:

1.Wireless Sensor and Actuator Networks Algorithms and Protocols for Scalable Coordination and Data Communication, Edited by AmiyaNayak and Ivan Stojmenovic A JOHN WILEY & SONS, INC., PUBLICATION,2010.

Reference Books:

1. Wireless Communications & Networks, 2nd Edition, William Stallings ,PearsonEducation India,2009.

2. Wireless Sensor Networks: An Information Processing Approach,Feng Zhao and Leonidas Guibas ,Morgan Kauffman Publication,2004.

Web Resources:

http://nptel.ac.in/courses/106105160/21https://online courses.nptel.ac.in/noc17_cs07/preview

CLOUD COMPUTING	
CSE 422(D)	**Credits: 3**
Instruction: 3Periods & 1Tut/ Week	Sessional Marks : 40
End Exam: 3Hours	End Exam Marks : 60

Prerequisites:

To Undertake this course student must have basic understanding of Data Communications and Networking Technologies.
Prior knowledge of computing and about the software systems.
Student must be familiar with the concept of , parallel and distributed programming

Course Objectives:

- To make students understand with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
- To enable students exploring some important cloud computing driven commercial systems such as GoogleApps, Microsoft Azure and Amazon Web Services and other businesses cloud applications

Course outcomes:

By the end of the course, the student will be able to:	
1.	To be familiar with the basics, challenges, need of cloud computing.
2.	Able to identify infrastructure of cloud
3.	Describing different cloud services
4.	Analyzing different cloud data storage and cloud security
5.	To analyze the need to migrate to the cloud and how cloud computing might evolve

Mapping of course outcomes with program outcomes:

Mapping		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	2			1				2	2	2	2		
	2	3	3	1		2				2	2	3	2		
	3	3	3	2		2				2	2	3	2		
	4	3	3	2		2				2	2	3	2		
	5	2	2	2		1				2	2	3	3		

SYLLABUS

Unit – I : 10 Periods

Cloud Computing Basics:

Cloud Computing Overview, Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing. Explain and contrast the role of Cloud computing within this space. Intranets and the Cloud, FirstMovers in the Cloud. The Business Case for Going to the Cloud - Cloud Computing Services introduction

Employability

Unit–II: **10 Periods**

Hardware and Infrastructure–Clients:

Mobile, Thick, Thin, Security:- Data Leakage, Offloading work, Logging, Forensics, Compliance VPNs, Key management ,Network- four different levels : Basic Public Internet, The Accelerated Internet, Optimized Internet Overlay Site-to-Site VPN, Services : - identify, integration, mapping, payment, search. Accessing the Cloud –Platforms.

Employability

Unit- III: **10Periods**

Cloud Services:

Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Software plus services - Overview, Cloud computing applications and business case for going to the cloud, Infrastructure as a Service--Amazon EC2, Platform as a Service—Right Scale, Salesforce.com ,Software as a Service--Google App Engine and Salesforce , --Microsoft's take on SaaS is slightly different with their Software plus Services (sometimes they shorten it to S+S) Software plus Services

Employability

Unit – IV : **12 Periods**

Cloud Storage and data storage security:

What is cloud storage? uses of cloud storage, Types of cloud storage, things looked for cloud storage, infrastructure, data types used in cloud computing, Data security challenges, VPN-Virtual Private Network ,FADE – File assured deletion ,TPA – Third Party Auditing. Cloud Security – need for security and privacy in cloud computing, Security and privacy issues

Unit-V: Employability **12 Periods**

Local Clouds, Thin Clients, Thick clients:

Types of Virtualizations, Virtualization in Your Organization, Server Solutions, Thin Clients, Migrating to the Cloud - Cloud Services for Individuals, Cloud Services Aimed at the Mid-Market, Enterprise-Class Cloud Offerings, Migration, Best Practices and the Future of Cloud Computing - Analyze Your Service, Best Practices, How Cloud Computing Might Evolve. Demonstration on VMware.

Employability

Text Book:

2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. "*Cloud Computing-A Practical Approach",1stEdition,*McGrawHill.

Reference Books:

1. Derrick Rountree and IleanaCastrillo, "*The Basics of Cloud Computing* ",
2. L. Wang, R. Ranjan, J. Chen, and B. Benatallah, "*Cloud Computing: Methodology, Systems, and Applications*", CRC Press, Boca Raton, FL,USA, ISBN: 9781439856413, October 2011.
3. Buyya R., Broberg J., Goscinski A., "*Cloud Computing: Principles and Paradigms*", John Wiley & Sons Inc., ISBN: 978-0-470-88799-8, 2011.

Web Resources:

1. http://nptel.ac.in/courses/106106129/28
2. https://www.coursera.org/learn/cloud-computing
3. https://www.edx.org/course/subject/computer-science/cloud-computing
4. http://www.guru99.com/cloud-computing-for-beginners.html
5. http://www.pritee.org/index.php/study-material/cloud-computing
6. https://cloudacademy.com/

PROFESSIONAL ELECTIVE – V

COMPUTING OPTIMIZATION	
CSE 422(E)	**Credits : 3**
Instruction **:** 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:
Basic Knowledge of algorithms and data structures.

Course Objectives:

- To understand evolutionary computing.
- To learn genetic algorithms.
- To be able to apply optimization techniques for solving latest computing problems.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Develop optimization models for various problem specific solutions.
2.	Apply evolutionary programming and strategies in engineering aspects.
3.	Design fitness functions.
4.	Apply variety of evolutionary programming computing techniques.

Mapping of Course Outcomes with Program Outcomes:

Mapping		PO												PSO	
		A	B	C	D	E	F	G	H	I	J	K	L	1	2
CO	1		2		2							1		1	2
	2	2	3		2					2		1		2	2
	3	3	2		3					3		2		2	3
	4	3	2		3					2		2		1	3

UNIT-I: **10 periods**

Introduction to Evolutionary Optimization:
Evolutionary algorithm, History, Application and need, Un-constrained optimization, Constrained Optimizations, Multi-objective optimization, Multi-modal optimization, Combinatorial optimization, Hill-climbing, Monte-Carlo importance, Intelligence- Adaptation, Randomness, Communication.

UNIT-II: **10 periods**

Genetic Algorithm (GA):
History- Charles Darwin, Gregor Mendel; A simple binary GA; Simple GA for Robot design; Selection; Cross-over; Mutation; Tuning parameters, Simple continuous GA.

Employability

UNIT-III: **12 periods**

Modeling GA:
Schema theory; Markov chains; Markov model for GA- Selection, mutation and cross-over; Dynamic system model- Selection, Mutation, Cross-over;

UNIT-IV: **12 periods**

Evolutionary Programming (EP) and Strategies:
Continuous EP; Finite-state-machine optimization; Discrete evolutionary programming; The Prisoner's dilemma; Artificial ant problem; (1 + 1) evolutionary strategy; The 1/5 rule of

derivation; The (μ + 1) evolution strategy; The (μ + λ) and (μ, λ) evolution strategy; Self- adaptive evolution strategy.

Employability

UNIT-V: **14 periods**

Genetic Programming (GP):

Overview of LISP; Fundamentals of GP- Fitness measures, Termination criteria, Termination set and Function set, Initialization; GP Parameters; Mathematical analysis of GP.

Employability

Evolutionary Algorithm Variation:

Initialization; Convergence; Gray-coding; Elitism; Population diversity; Selection options; Recombination; Mutation.

Employability

Text Books:

5. Dan Simon, *" Evolutionary Optimization Algorithms",* Wiley.

Reference Books :

1. ZbigniewMichalewicz, "*Genetic Algorithms + Data Structures = Evolution Programs*", Springer.

Web Resources:

3. https://onlinecourses.nptel.ac.in/noc18_me17/preview
4. http://nptel.ac.in/courses/105108081/37

DATA STRUCTURES

IT211 **Credits:4**
Instruction: 4 Periods & 1Tut/week Sessional Marks:40
End- Exam:3Hours End-Exam-Marks: 60

Prerequisite: C Programming

Course Objective:

- Assess how the choice of data structures impacts the performance ofprograms.
- Choose the appropriate data structure and algorithm design method for a specified application.
- Solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Compare and contrast the benefits of dynamic and static data structures: linked lists and arrays.
2.	Evaluation of infix, prefix and postfix expressions and conversion between infix, prefix and postfix using stacks. Implement linear data structure Queue using arrays and linked lists.
3.	Implement sorting and searching techniques and analyze their computational complexity worst, average and best in terms of the size of the list(n)
4.	Solve and analyze time complexities of shortest path problem usingnonlinear data structures trees and graphs with Prims and Krushkals algorithms and Dijkstra's & Warshall's algorithms.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	2	3					1	1	1		1	3	2
	2	1	1	2					1	1	1		1	3	2
	3	2	2	3					1	1	1		1	3	2
	4	2	3	2					1	1	1		1	3	2

SYLLABUS

Unit-I:Introduction **12 Periods**

Introduction to data structures, arrays and structures. Dynamic Memory Management, Abstract Data Type (ADT). Introduction to Time and Space complexity and their tradeoffs.

List: Definition and examples- Primitive Operations- Representation using array and Linked List. Types of Linked Lists and implementation: single, double and circular. The array and linked list advantages, disadvantages and applications.

Unit-II: StacksandQueues **12 Periods**

The Stack ADT: Definition, Primitive Operations and representation. Stack ADT implementation using array and linked list. Applications of Stacks: Prefix, infix and Postfix notations, conversion between infix, prefix and postfix, postfix evaluation using stacks. Recursion: definition and examples (ex: Towers of Hanoi Problem, other examples).

Queue ADT: Definition, Primitive operations and Representation. Queue ADT implementation using array and linked list. Types of Queue: Circular Queue, Priority Queue, De-queue Operations and implementation using array and linked list. The queues advantages, disadvantages, and applications.

Unit - III: SortingandSearching **12Periods**

Sorting: General background, selection sort, bubble sort, insertion sort, shell sort, radix sort, quick sort and merge Sort.

Searching: General background, linear search, binary search and Interpolation search. Introduction to Hashing, Hash Function, Hashing techniques, Collision Resolution Methods: Open Addressing, Chaining.

Unit-IV:Trees **12 Periods**

Trees: Introduction, Terminology, Binary trees: Terminology, Representation. Binary tree implementation using array and linked list. Tree Traversal Techniques, applications and threaded binary trees.

Types: Heap, Binary Search Tree, AVL Tree, B-Tree of order m, introduction to Red-Black tree.

Unit-V:Graphs **16periods**

Graphs: Introduction- terminology, Representation of graphs-linked list and adjacency matrix, Representation in C, Implementation of graphs using arrays and linked list, Graph traversals- Breadth-First Search, Depth-First Search. Spanning Trees: Introduction and terminology, Minimum Spanning Tree algorithms: Prims and Krushkals. Applications of Graphs: Dijkstra's & Warshall's Algorithm.

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structure, computer sciencePress.

REFERENCE BOOKS:

1. Y.Langsam,M.AugenstinandA.Tannenbaum,"DataStructuresusingC"PearsonEducation , 2nd Edition, 1995.
2. Richard F, Gilberg ,Forouzan, Cengage ,"Data Structures", 2/e,2005.

DIGITAL LOGIC DESIGN
(COMMON FOR CSE & IT)

IT212 **Credits:3**

Instruction: 3 Periods & 1Tut/week Sessional Marks:40

End- Exam :3Hours End-Exam-Marks:60

Prerequisite:

Computer fundamentals.

Course Objective:

- To provide knowledge and understanding of Boolean algebra and digitalconcepts.
- To provide the knowledge of analyzing and designing of combinational and sequential logicnetworks.
- HDL in this course provides the ability to synthesize the designs in Verilog HDL or VHDL.

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Analyze and synthesize logic circuits by applying the knowledge of number systems, codes, Boolean algebra and digital logic circuits to solve typical problems on the same.
2.	Minimize the given Switching function in SOP and POS forms using K-Map & Design of different types of combinational logic circuits using various logic gates.
3.	Design and analyze synchronous sequential logic circuits including registers & counters using gates & flip-flops
4.	Design combinational logic circuits using different types of PLDs, namely, PROM, PLA and PAL.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2								3		3		2	2
	2	3								3		3		3	3
	3	3								3		3		2	2
	4	3								3		3.		3	3

SYLLABUS

UNIT-I: Binary Systems, Boolean Algebra andLogicGates **10 Periods**

Digital Systems, Binary Numbers, Number Systems, Base Conversion Methods, Complements, Signed Binary Numbers, Binary Codes, BinaryLogic.

Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra. Boolean Functions, Canonical and Standard Forms, Different Logic Operations, Digital Logic Gates.

UNIT-II:Gate-LevelMinimization **4Periods**

The Map Method, Minimal Functions and their properties, Don't-Care Conditions, Tabulation Method, NAND and NOR Implementation, Other Two- Level Implementations, Verilog Hardware Description Language (Verilog HDL).

CombinationalLogicDesign: **6Periods**

Combinational Circuits, Analysis Procedure, Design Procedure, Design of adders, subtractors, adder-subtractor circuit, BCD adder circuit, applications of adders, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, Demultiplexers, Verilog HDL For CombinationalCircuits.

UNIT-III: SequentialLogicCircuits **5 Periods**

Sequential Circuits, Latches, Flip-Flops, Analysis of Clocked Sequential Circuits,Flip-Flop Conversions, Verilog HDL for SequentialCircuits.

RegistersandCounters **6Periods**

Registers, Shift Registers, Ripple Counters, Synchronous Counters, Johnson and Ring counters, Verilog HDL for Registers and Counters.

UNIT-IV: SynchronousSequentialLogic **4Periods**

Basic Design Steps, Serial Adder Example, State Reduction & Assignment Problem.

Fundamentals of AsynchronousSequentialLogic **5 Periods**

Introduction, Analysis Procedure, Design Procedure, circuits with latches, Races andHazards.

UNIT-V: ProgrammableLogicDevices **8 Periods**

Programmable Logic Devices : PROM, PLA, PAL, realization of switching functions using PROM, PLA and PAL; comparison of PROM, PLA and PAL, Programming tables of PROM, PLA and PAL, Sequential ProgrammableDevices.

Text Books :

1. M. Morris Mano, Digital Design, Pearson Education, Inc., 2008, 4thEdition.

Reference Books:

2. ZviKohavi, Switching and Finite Automata Theory, Tata McGraw-Hill, 1978, 2ndEdition.
3. Frederick,IntroductiontoSwitchingTheoryandLogicalDesign,2011&J.HillandGerald R. Peterson, John Wiley and Sons, 2011, 3rd Edition.
4. William I. Fletcher, An Engineering Approach to Digital Design, PHI,2008.

DISCRETE MATHEMATICAL STRUCTURES
(COMMON FOR CSE & IT)

IT213 **Credits:4**

Instruction: 4 Periods & 1Tut/week Sessional Marks:40

End- Exam:3Hours End-Exam-Marks:60

Prerequisite:

Engineering Mathematics-1, Engineering Mathematics-2.

Course Objective:

- The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in differentdisciplines.

Course Outcomes:

After completion of this course, a student will be able to :	
1.	To understand set theory, relations, mathematical logic, mathematical reasoning and to study about the validity of the arguments.
2.	Be able to apply basic counting techniques to solve combinatorial problems.
3.	To understand Recurrence Relation, Generating functions and solving problems involving recurrence equations.
4.	To familiarize the different types of binary relations and related algorithms on transitive closure.
5.	To familiarize with the applications of graphs, trees and algorithms on minimal spanning tress.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2								2		2	3	3	3
	2	3	2											3	3
	3	2												2	2
	4	2												2	2
	5	2		2										2	2

SYLLABUS

UNIT-I:MATHEMATICALLOGIC 15Periods

Sets-Operations on sets-relations-functions-Fundamentals of Logic- Logical inferences-Methods of proof of an implication-First Order logic and other methods Proof -Rules of inference for quantified Propositions –Mathematical Induction.

UNIT II:ELEMENTARYCOMBINATORICS 8Periods

Basics of Counting- Combinations and Permutations-Their Enumeration with and without repetition-Binomial coefficients-Binomial and Multinomial Theorems-The Principle of Inclusion-Exclusion.

UNIT III:RECURRENCERELATIONS 8Periods

Generating Functions of Sequences-Calculating their Coefficients-Recurrence relations-Solving recurrence relations-Method of characteristic Roots- Non-homogeneous Recurrence relations and their solutions.

UNIT IV: RELATIONSANDDIGRAPHS 9Periods

Relations and directed Graphs - Special Properties of Binary relations- Equivalence Relations- Ordering Relations-Lattices and Enumeration- Operations on relations-Paths and Closures-Directed Graphs and Adjacency matrices .

UNITV:GRAPHS 20Periods

Introduction to Graphs – types of Graphs – Graphs basic terminology and special types of simple graphs – representation of graphs and graph isomorphism – Euler paths and circuits- Hamilton paths and circuits – Planar graphs – Euler's formula.

Introduction to Trees and their properties – Spanning Trees – Depth First Search , Breadth First Search – Minimum Spanning Trees – Kruskal's Algorithm and Prim's Algorithm.

Text Books:

1) Joe L. Mott, Abraham Kandel & T. P. Baker, "Discrete Mathematics for computer scientists & Mathematicians" Prentice Hall of India Ltd, New Delhi.

Reference Books:

1) Keneth. H. Rosen, "Discrete mathematics and its applications", Tata McGraw-Hill Publishing Company, NewDelhi.
2) Richard Johnsonbaug ,"Discrete mathematics" , Pearson Education, NewDelhi.

COMPUTER ORGANIZATION

IT214 **Credits:4**

Instruction: 4 Periods & 1Tut/week Sessional Marks:40

End Exam:3Hours End Exam Marks:60

Prerequisite:

Computer fundamentals.

Course Objectives:

- Clearly differentiate between Computer Organization and ComputerArchitecture.
- Identify and describe the functions of all the basic components making up a computer system.
- Present, as clearly and completely as possible, the characteristics of modern-day computer systems, highlighting on the CPU Organization & Operation, Number systems, Operating Systems Memory Systems, Logic Circuits Design and I/O andInterfacing.
- Engage into contrast discussions based on the two CPU design philosophies i.e the Complex Instruction Set.
- Computers (CISC) and Reduced Instruction Set Computers (RISC)systems

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Solve problems using micro operations and perform computer arithmetic operations on integer and real numbers.
2.	Discriminate hardwired and micro programmed way of designing the control unit of a digital computer
3.	Describe the organization of digital computers and identify addressing modes, Instruction formats and types of instructions. or Write an ALP for a given task with the knowledge of computer organization, addressing modes and instruction set.
4.	Evaluate the performance of CPU, Memory and I/O operations.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	1	2				1	2		2	2	2	1
	2	2	2	2	3					2	1	2	2	2	1
	3	3	2	2	2	3			1		1	2	3	2	1
	4	2	2	2	3					3		3	3	2	1

SYLLABUS

UNIT-I: **14Periods**

Register transfer and micro operations:

Register Transfer Language, Bus and Memory Transfers, Arithmetic, Logic and Shift Micro operations, Arithmetic Logic Shift Unit

SKILL DEVELOPMENT

SKILL DEVELOPMENT

Computer Arithmetic:

Introduction, Addition and Subtraction, Booth Multiplication Algorithm, Decimal Arithmetic Unit.

UNIT-II: **12Periods**

skill development

Basic Computer Organization:

Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Complete Computer Description.

UNIT-III: **12Periods**

Control Design:

Hardwired & Micro Programmed (Control Unit), Control Memory, Address Sequencing, Conditional and Unconditional Branching, Micro program Example.

UNIT-IV: **12Periods**

Central Processing Unit:

Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes with numerical examples, Data Transfer and Manipulation, Program Control, Program Interrupt, Types of interrupts, CISC Characteristics, RISC Characteristics..

skill development

UNIT-V: **14Periods**

Input-Output Organization:

Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access.

skill development

Memory Organization:

Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, VirtualMemory.

skill development

TEXTBOOKS:

1. M.MorrisMano ,Computer System Architecture, Third Edition, Pearson Education Inc., 2003

REFERENCE BOOKS:

1. John D. Carpinelli, Computer Systems Organization and Architecture,Pearson Education Inc.,2003.
2. William Stallings, Computer Organization and Architecture,5thEdition,2000.

DATA COMMUNICATIONS

IT215 **Credits:3**

Instruction: 3 Periods & 1Tut/week Sessional Marks:40

End Exam:3Hours End Exam Marks:60

Prerequisite:

Computer fundamentals.

Course Objectives:

- Introduce students to the evolution of computer networks and the concepts data communication
- Introduce students the general principles of network design and compare the different networktopologies
- Introduce students to the digital and analogue representations andchannels
- Describe the mechanism and techniques ofencoding
- Introduce students to the general principles of circuit and packetswitching
- Introduce students to the wireless Local AreaNetworks
- Provide students with in-depth knowledge of data link layer fundamental such as error detection, correction and flow control techniques; multiple access controltechniques

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Understand the basic concepts of Data Communications and different models
2.	Understand and analyses the characteristics of signals propagated through different transmission Media
3.	Apply signal encoding techniques, error detection, correction techniques and learn interfacing
4.	Distinguish various Multiplexing techniques and learn various modems like ADSL, xDSL.
5.	Illustrate various Data link control protocols namely flow control, error control and HDLC

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2		3	1						3		3	3
	2	3	3							2				3	3
	3	2	3			1								3	3
	4	3		2			1						1	3	3
	5	2	2	3								1		3	3

SYLLABUS

UNIT:I **12periods**

Data Communication overview: A communication model, Data communications, Data Communication networking- Introduction to WAN, LAN, wireless Networks, MAN, an example configuration **Data Transmission**: Concepts and Terminology-Transmission terminology, Frequency, spectrum and Bandwidth Analog and Digital Data Transmission-

Introduction to Analog and Digital Data, Analog and Digital Signals, Analog and Digital Transmission, Transmission Impairments-Attenuation, Delay Distortion, Noise, channel Capacity-Nyquist Bandwidth, Shannon Capacity Formula, The expression Eb/N0 **Transmission media**: guided transmission media-Twisted pair, coaxial cable, Optical fiber, Wireless transmission – Antennas, terrestrial microwave, satellite microwave, Broadcast Radio, Infrared Wireless Propagation- Ground wave propagation, sky wave propagation, Line- of-sight Propagation, Line-of-sight Transmission- free space loss, Atmospheric Absorption, Multipath, Refraction

UNIT:II **10periods**

Signal Encoding Techniques: Digital Data Digital signals (Nonreturn to Zero(NRZ), multilevel Binary, Biphase, Modulation rate), Digital Data Analog Signals (Amplitude shift keying, frequency shift keying, Phase Shift keying, Quadrature Amplitude Modulation), Analog Data Digital Signals (Pulse code Modulation, Delta Modulation), Analog Data Analog Signals (Amplitude Modulation, AngleModulation)

UNIT:III **6periods**

Digital Data communication Techniques: Asynchronous and synchronous Transmission-Asynchronous Transmission, synchronous transmission, Types of Errors, Error Detection-parity check, CRC, Error correction-Block Code Principles, Line configuration-Topology, Full Duplex and Half Duplex, Interfacing – V.24/EIA-232-F, ISDN PhysicalInterface

UNIT:IV **10periods**

Multiplexing: Frequency Division Multiplexing -Characteristics, Analog carrier systems, wave length-Division Multiplexing, Synchronous Time Division Multiplexing- Characteristics, TDM link control, Digital carrier systems, SONET/SDH , Statistical Time Division Multiplexing- characteristics, performance, cable modem, Asymmetric digital subscriber line-ADSL Design, Discrete Multitone, xDSL-HDSL,SDSL,VDSL,modems

UNIT:V **10 periods**

Data Link Control: Flow Control-stop and wait flow control, sliding window flow control, Error Control- stop-and-wait ARQ, selective- Reject ARQ , High Level Data Link Control (HDLC) – Basic Characteristics, Frame Structure, operation **,** Architecture of computer network, layered approach,X.25, Frame relay,ATM.

Basic hardware: RJ-45, Network interface card, rack, cable standard-Category 5,6, and 7, cross connection, straight connection cable coding standards.

Text Books:

1. William Stallings ,"Data& Computer Communication", Pearson Education, 7th edition

Reference Books:

1. Forouzan, "Data communication and networking", TATA McGraw, 4thedition
2. Gupta Prakash C.,"Data communication", PHILearning
3. Tomasi, "Introduction to Data Communication & Networking", PearsonEducation.
4. A.S Tanenbum, "Computer Network", PearsonEducation

DATA STRUCTURES LAB

IT216 **Credits:2**

Practical: 3Periods/week Sessional Marks:50

End Exam:3Hours End Exam Marks:50

Prerequisite:

C Programming, Data Structures.

Course Objective:

- Assess how the choice of data structures impacts the performance ofprograms.
- Choose the appropriate data structure and algorithm design method for a specified application.
- Solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Implement linear data structures such as stacks, queues, linked lists and apply on real time problem like conversions & evaluations of expressions.
2.	Implement non linear data structures such as Trees and Graphs and apply on real time problem like finding shortest path.
3.	Implement different sorting and searching techniques.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3	3	3	3	2	2		3	2	3	3	3	3
	2	3	3	3	3	3	2	2		3	2	3	3	3	3
	3	3	3	3	3	3	2	2		3	2	3	3	3	3

List of Programs:

1) Programs to implement the following using anarray.

a) Stack b)Queue

2) Programs to implement the following using a singly linkedlist.

a) Stack b)Queue

3) Program to do thefollowing

a) Infix topostfixconversion. b) Evaluation of postfixexpression.

4) Programs to implement the following datastructures.
a) CircularQueue b) PriorityQueue

5) Implement primitive operations of de-queue (double ended queue) using a doubly linkedlist and anarray.

6) Program to perform the followingoperations:
   a) Insert an element into a binary searchtree.
   b) Delete an element from a binary searchtree.
   c) Search for a key element in a binary searchtree.

7) Program that use non-recursive functions to traverse the given binary treein
a) Preorder b)In-order c)Post-order.

8) Program to implement bfs and dfs for a givengraph.

9)) Program to implement the following sortingmethods:
a) Mergesort b)Quicksort c) InsertionSort d) SelectionSort

10)) Program to implement the following searchingmethods:
a) LinearSearch b) Binarysearch

11) Program to store **k** keys into an array of size n at the location computed using a Hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n, where m is sizeof the hashtable.

12) Write a C program to handle the collisions using the following collisionresolution Technique
a) Linearprobing b) Quadratic probing c) SeparateChaining

Reference Books:

1. Y. Langsam, M. Augenstin and A. Tannenbaum, “Data Structures using C”Pearson Education, 2nd Edition, 1995.
2. Richard F, Gilberg, Forouzan, Cengage, Data Structures, 2/e,2005.
3. Data Structures using C, 2/2, ISRDGroup.

DIGITAL ELECTRONICS LAB
(COMMON FOR CSE & IT)

IT217 **Credits:2**

Practical: 3Periods/week Sessional Marks:50

End Exam:3Hours End Exam Marks: 50

Prerequisite:

Digital electronics concepts.

Course Objectives:

- To understand how to design and analyze the electronic circuits usingsemiconductor diodes and operationalamplifiers
- To understand how to design various combinational and sequentialcircuits.
- To develop and test VHDL Program code for combinational and sequentialcircuits.

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Identify various analog (active and passive), digital electronic components.
2.	Design and Analyze different circuits using analog ICs like operational amplifier and regulators.
3.	Simplify the given Boolean function and implement using logic gates using Integrated Circuits.
4.	Design, Analyze and Implement combinational and sequential digital circuits.
5.	Model combinational and sequential digital circuits using VHDL program in behavioral, structural, and dataflow models.
6.	Develop test benches to simulate combinational and sequential circuits, perform functional and timing verifications of digital circuits.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2					2			3	2	2	1		
	2	2					2			3	2	2	1		
	3	3	1	3	2		1			3	2	2	2		
	4	3	1	3	2		2			3	2	2	2		
	5	2	2	2	3	1	2			3		3	1		
	6	2	2	2	3	1	2			3		3	1		

LIST OF LABORATORY EXPERIMENTS

CYCLE I:

1. Study of passive, active components & IntegratedCircuits.
2. To study the regulation characteristics of given IntegratedCircuits.
3. To verify the adder operation & subtractor operation using Operationalamplifiers.
4. To verify the truth tables of given LogicGates.

CYCLE II:

1. Verification of truth tables of Logic gates usingIC's.
2. Design a combinational circuit for Code Converters usingIC's.
3. Design a combinational circuit for Adders & Subtractors (HA & FA) usingIC's.
4. Design a sequential circuit for Flip-flop and verify its characteristics usingIC's..
5. Design a bidirectional Universal Shift Register UsingIC74LS194.
6. Design of Counters usingIC74LS73.

CYCLE III: (Simulation using VHDL)

1. Write a program for verification of BasicGates.
2. Write a program for Adder &Subtractor.
3. Write a program for flipflops.
4. Write a program for MUX &DEMUX.
5. Write a Program for ShiftRegisters.

*** NOTE: FOUR Experiments from each cycle should be donecompulsorily.**

Reference Books:

1. M. Morris Mano, Digital Design, Pearson Education, Inc., 2008, 4th Edition.

PYTHON PROGRAMMING LAB

IT218 **Credits:3**

Practical: 3 Periods & 1Tut/week Sessional Marks: 50

End Exam:3Hours End Exam Marks:50

Prerequisite:

Fundamentals of computers, knowledge in any program language

Course Objective:

- Describe the basic elements of the Python language and the Pythoninterpreter
- Analyze and demonstrate the use of lists, tuples and dictionaries inPython.
- Write classes to demonstrate the ideas of encapsulation, inheritance, interfaces and object oriented programdesign.
- Explain and demonstrate methods of error handling and Pythonexceptions.
- Write to and read from files using intermediate file I/O operations in a Pythonprogram.
- Solve problems that have origins in a variety of disciplines including math, science, the Internet andbusiness.

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Analyse the syntaxes of python programming and incorporate them in problem solving.
2.	Apply python data structures to solve real world problems.
3.	Develop programs using object oriented concepts in python programming
4.	Develop programs using File I/O and exception handling.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	3	3	2	2			2		1	2	3	2
	2	3	3	2	3	3	3			3		2	3	3	3
	3	3	3	3	3	3	3			3		1	3	3	3
	4	3	3	2	3	3	3			3		1	3	3	3

List of the experiments to be done on the following topics

1. Introduction: Introduction to Python programming language, using the interpreter, running scripts, variables, assignments, comments, operators and expressions. Introduction tobasic data types including strings, integers, lists and tuples.

2. Control Flow: Conditional expressions, if statement, for statement and while statement, break and continuestatements.

3. Functions, Methods and Modules: Introduction to built in functions, methods and modules. Introduction to standard library modules like sys, os, time and random. Reading command line arguments. Introduction to writing user defined functions and organizing code intomodules.

4. Data structures: Detailed overview of four major data structures of Python including list, tuple, set and dictionary, including list slicing, sorting lists, listcomprehensions.

5. Working with Files: Introduction to reading and writing files, text and binary mode. Writing parsers for simple textformats.

6. Classes and Exceptions : Introductions to classes, object creation and class inheritance and overriding methods. Introduction to exceptionhandling.

7. Advanced Topics

Introduction to some advanced topics in Python.

- Downloading things fromweb
- Webprogramming
- Datavisualization
- Building simple games usingpygame

LIST OF EXPERIMENTS

LEVEL 1: FUNDAMENTAL PROGRAMMING

1. Installation of Python using python interpreter and printing HELLO WORLDmessage
2. program that accept the user's first and last name and print them in reverse order witha space betweenthem
3. To display the first and last colors from the followinglist. color_list = ["Red","Green","White","Black"]
4. To count the number of characters (character frequency) in a string . Sample String: google.com' Expected Result : {'o': 3, 'g': 2, '.': 1, 'e': 1, 'l': 1, 'm': 1, 'c':1}

5. To convert temperatures to and from celsius,fahrenheit.
[Formula : c/5 = f 32/9 [where c = temperature in celsius and f = temperature in fahrenheit] . *Expected Output* : 60°C is 140 in Fahrenheit 45°F is 7 in Celsius

6. To get a list, sorted in increasing order by the last element in each tuple from a givenlist of non emptytuples.
Sample List : [(2, 5), (1, 2), (4, 4), (2, 3), (2, 1)]
Expected Result : [(2, 1), (1, 2), (2, 3), (4, 4), (2, 5)]

7. Write a function translate() that will translate text into "rovarspraket" (Swedish secret language) That is double every consonant and place an occurence of "o" in between .For example translate("this is fun") should return the string "tothohisos isosfofunon"

8. program that prints each item and its corresponding type from the followinglist.
Sample List :datalist = [1452, 11.23, 1+2j, True, 'w3resource', (0, 1), [5, 12], {"class":'V', "section":'A'}]

9. Write a Python function that takes a list and returns a new list with unique elementsof the first list. *Sample List:*[1,2,3,3,3,3,4,5] *Unique List :* [1, 2, 3, 4,5]

10. programs for thefollowing:
   a. Defining and Accessing aDictionary:
   b. UpdatingDictionary:
   c. Deleting DictionaryElements:
   d. Defining and Accessing, updating ,deletingTuples.

11. To demonstrate the use of built in stringmethod

12. To demonstrate the use oflists

LEVEL 2 : CLASSES AND I/O

13. To implement classes concept inpython
14. To implement inheritance in a Bankingsystem
15. To implementpolymorphism
16. Python Programs on ExceptionHandling
   a. Write a python program to handle Number formaterror
   b. Write a python program to handleIOError
17. Write a python program to perform the following fileoperations.
   a. Create, open & close afile:
   b. write content on to afile
   c. Read content form thefile
   d. Random access operation on files using tell & seekfunctions
   e. other file operations using the Module'os'

LEVEL 3 : PROBLEM SOLVING

18. Cryptography:

In cryptography, a *Caesar cipher* is a very simple encryption techniques in which each letter in the plain text is replaced by a letter some fixed number of positions down the alphabet. For example, with a shift of 3, A would be replaced by D, B would become E, and so on. The method is named after Julius Caesar, who used it to communicate with his generals. *ROT 13* ("rotate by 13 places") is a widely used example of a Caesar cipher where the shift is 13. In Python, the key for ROT 13 may be represented by means of the following dictionary:

key = {'a':'n', 'b':'o', 'c':'p', 'd':'q', 'e':'r', 'f':'s', 'g':'t', 'h':'u',

a. 'i':'v', 'j':'w', 'k':'x', 'l':'y', 'm':'z', 'n':'a', 'o':'b','p':'c',
b. 'q':'d', 'r':'e', 's':'f', 't':'g', 'u':'h', 'v':'i', 'w':'j','x':'k',
c. 'y':'l', 'z':'m', 'A':'N', 'B':'O', 'C':'P', 'D':'Q', 'E':'R','F':'S',
d. 'G':'T', 'H':'U', 'I':'V', 'J':'W', 'K':'X', 'L':'Y', 'M':'Z','N':'A',
e. 'O':'B', 'P':'C', 'Q':'D', 'R':'E', 'S':'F', 'T':'G', 'U':'H','V':'I',
f. 'W':'J', 'X':'K', 'Y':'L','Z':'M'}

Your task in this exercise is to implement an encoder/decoder of ROT 13. Once you're done, you will be able to read the following secret message:

Pnrfnepvcure? V zhpucersrePnrfnefnynq!

Note that since English has 26 characters, your ROT 13 program will be able to both encode and decode texts written in English.

19. Speech synthesis:

The *International Civil Aviation Organization (ICAO) alphabet* assigns code words tothe letters of the English alphabet acrophonically (Alfa for A, Bravo for B, etc.) so that critical combinations of letters (and numbers) can be pronounced and understood by those who transmit and receive voice messages by radio or telephone regardless of their native language, especially when the safety of navigation or persons is essential. Here is a Python dictionary covering one version of the ICAOalphabet:

d = {'a':'alfa', 'b':'bravo', 'c':'charlie', 'd':'delta', 'e':'echo', 'f':'foxtrot',
'g':'golf', 'h':'hotel', 'i':'india', 'j':'juliett', 'k':'kilo', 'l':'lima',
'm':'mike', 'n':'november', 'o':'oscar', 'p':'papa', 'q':'quebec', 'r':'romeo',
's':'sierra', 't':'tango', 'u':'uniform', 'v':'victor', 'w':'whiskey',
'x':'x ray', 'y':'yankee', 'z':'zulu'}

Your task in this exercise is to write a procedure `speak_ICAO()`able to translate any text (i.e. any string) into *spoken*ICAO words. You need to import at least two libraries: `os`and `time`. On a mac, you have access to the system TTS (Text To Speech) as follows: `os.system('say ' + msg)`, where `msg` is the string to be spoken. (Under UNIX/Linux and Windows, something similar might exist.) Apart from the text to be spoken, your procedure also needs to accept two additional parameters: a float indicating the length of the pause between each spoken ICAO word, and a float indicating the length of the pause between each word spoken

20. Cows and bulls game:

Create a program that will play the "cows and bulls" game with the user. The game works like this:
Randomly generate a 4 digit number. Ask the user to guess a 4 digit number. For every digit that the user guessed correctly *in the correct place*, they have a "cow". For every digit the user guessed correctly *in the wrong place* is a "bull." Every time the user makes a guess, tell them how many "cows" and "bulls" they have. Once the user guesses the correct number, the game is over. Keep track of the number of guesses the user makes throughout the game and tell the user at the end.
Say the number generated by the computer is 1038. An example interaction could look like this:

```
Welcome to the Cows and Bulls Game!
Enter a number:
>>> 1234
2 cows, 0 bull
>>> 1256
1 cow, 0 bull
...
```

21. Chip defect

k defects are randomly distributed amongst *n* integrated circuit chips produced by a factory (any number of defects may be found on a chip and each defect is independent of the other defects). Let p(*k,n*) represent the probability that there is a chip with at least 3 defects. For instance p(3,7) ≈ 0.0204081633.

Find p(20 000, 1 000 000) and give your answer rounded to 10 decimal places in the form 0.abcdefghij

Reference Books:

1. *Swaroop C H* , A Byte of Python, http://python.swaroopch.com/
2. *David Beazley* , Python Cookbook, 3rd edition, O'ReillyMedia http://chimera.labs.oreilly.com/books/1230000000393/
3. *Mark Pilgrim* , Dive Into Python 3, http://www.diveinto.org/python3/

Other References:

1. Project Euler https://projecteuler.net/

COMPUTER NETWORKS

IT221 **Credits:3**

Instruction: 3 Periods & 1Tut/week Sessional Marks:40

End Exam:3Hours End Exam Marks:60

Prerequisite:

Data Communications.

Course Objective:

- To provide the students with a sound theoretical and practical knowledge in computer networks.
- To analyze problems associated while connecting components for sharinginformation.
- To select a protocol stack for specificnetwork.
- To select proper algorithm for the protocols..
- To identify the parameters for real time applications innetworks.
- Prepare students for easy transfer from academia to realworld.

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Be able to analyze different network architecture's and designs
2.	Mathematically model various error control and routing schemes.
3.	Ability to analyze the working of LAN in an organization.
4.	Ability to design network architecture for an organization.
5.	Ability to design and implement a network for scalability and robustness and security.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3				3						3		3	3
	2	3				3				2				3	3
	3	3				3				2				3	3
	4	3				3				2		2		3	3
	5	2										3		3	3

SYLLABUS

UNIT– I **10periods**

Protocol Architecture: The need for a protocol architecture, A simple protocol architecture A three layer model, standardized protocol architectures , OSI The model, standardization within the OSI framework, service primitives and parameters, the OSI layers , The TCP/IP protocol Architecture The TCP/IP layers, TCP and UDP Operation of TCP and IP, TCP/IP applications, protocol Interfaces, **Local area networks: LAN overview:** Background, LAN protocol Architecture LAN standards, IEEE 802, LLC,MAC. Bridges functions, protocol architecture, Fixed routing, spanning tree approach. Layer 2 and Layer 3 switches hubs, layer2 and3 switches. **High speed LANs:** The Emergence of High speed LANs, Ethernet MAC, Ethernet, fast Ethernet, gigabit, 10 gbpsTokenRing Operation, MAC. **Wireless LANs:** overview, Wireless LAN Technology, IEEE802.11 Architecture and services, MAC, PhysicalLayer

UNIT– II **10 periods**

Wide Area Networks: circuit switching and packet switching: switched communication networks, circuit switching networks and concepts Space Division Switching, Time division switching, packet switching principles switching technique, packet size, comparisons. **Routing in switched networks:** Routing in circuit switching networks, routing in packet switching networks Characteristics, routing strategies, Examples, Least cost Algorithms Dijikstra's Algorithm, Bellman Ford algorithm, comparison. **Congestion Control in Switched Data Networks:** effects of congestion ideal performance, practical performance, congestion control Backpressure, choke packet, implicit congestion signaling, explicit congestion signaling, traffic management fairness, QOS, Reservations, congestion control in packet switchingnetworks

UNIT – III **10 periods**

Internetworking: Internetwork protocols: Basic protocol Functions, principles of Internetworking requirements, Architectural Approaches, connectionless Internetworking operation of connectionless internetworking scheme, Design issues, Internet protocol IP services, Internet protocols, IP Addresses, ICMP, IPV6 IP next generation, IPv6 structure, IPv6 header, IPv6 Addresses, Hop by Hop options header, routing header, destination options header. **Internetwork operation:** Multicasting, routing protocols Autonomous systems, approaches of routing, BGP, open shortest path first(OSPF)protocol

UNIT– IV **10periods**

The Transport Layer: **The Transport Protocols:** connection Oriented transport protocol mechanisms Reliable sequencing network service, unreliable network service, TCP TCP services, TCP header format, TCP Mechanisms, TCP Implementation policy options, TCP congestion control Retransmission timer management, window management,UDP

Unit– V **8periods**

Application Layer: **Distributed Applications**: Electronic Mail SMTP and MIME Simple mail transfer protocol (SMTP), multipurpose internet mail extensions (MIME). Hypertext transfer protocol (HTTP) HTTP overview, messages, request message, response messages, Entities Network management SNMP network management systems, SNMPv1, SNMPv2

skill development

Text Books:

1. William Stallings ,"Data& Computer Communication", Pearson Education ,7th edition

Reference Books:

1. Forouzan, "Data communication", TATAMcGraw
2. Kurose & Ross, "COMPUTER NETWORKS– A Top-down approach featuringthe Internet", Pearson Education, Alberto Leon,Garciak.
3. LeonGartia, IndraWidjaja, "Communication Networks Fundamental Concepts and Key Architectures",TMH.
4. Nader F.Mir, "Computer and Communication Networks",PHI.

INFORMATION SYSTEMS DESIGN

IT222 **Credits:3**

Instruction: 3 Periods & 1Tut/week Sessional Marks:40

End Exam:3Hours End Exam Marks:60

Prerequisite:

Object Oriented Concepts, C++ programming.

Course Objective:

- On performing a background work prior to begin Projectdevelopment.
- To gather information and analyze user requirements in systemdevelopment
- To apply the Process models in developing aproject.
- To translate end user requirements into system and softwarerequirements

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Identify the features of Information systems and systems design.
2.	Apply the knowledge of information gathering and requirement analysis in SoftwareEngineering
3.	Identify specific components of a software design and use in Interface Designing.
4.	Analyze software testing methodologies and estimate the software development cost.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	3	3	2	1	1				2	2	3	3
	2	2	2	2	2	1					2	2	2	3	3
	3	2	3	3	3	3						1	2	3	3
	4	2	2	3	1	3						1	2	2	3

SYLLABUS

UNIT I: TextBook 1 **8Periods**

Information and Management: Types of Information, Computer based information systems, Management Structure , Management and Information Requirements, Qualities of information **(Page No 1 12)**

Examples of Information Systems: Various functions in organizations, Information Processing for a store – An overview , varieties of Information Systems**. (Page No 3122)**

Information Gathering : Strategy to Gather information ,Information Sources, Methods of Searching for Information, Interviewing Techniques, Questionnaires Other methods Case Study – Hostel Information System **(Page No 34 45)**

UNIT – II: TextBook2 **11 Periods**

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths. **(Page No 33 47)**

A Generic view of process: Software engineering A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models. **(Page No 5273)**

Process models: The waterfall model, Incremental process models, Evolutionary process models, The Unified process. **(Page No 7799)**

UNIT – III: TextBook2 **10 Periods**

Requirements Engineering : Requirements Engineering Tasks ,Initiating the requirements engineering process, Eliciting requirements, developing use cases, Building the analysis model, Negotiating requirements, validating requirements. **(Page No 176204)**

Building analysis model: Requirement analysis, Analysis modeling approaches **(Page No 208 212)**

UNIT – IV: TextBook2 **11Periods**

Design Engineering: Design process and Design quality, Design concepts, the design model. **(Page No 261 280) Performing User interface design:** Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation. **(Page No 357382)**

UNIT – V: TextBook2 **8Periods**

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Validation testing, System testing **(Page No 387 404,406 410)**

Black Box and White Box testing, Basic Path Testing, Control Structure Testing **(Page No 423 434)**

Product metrics: Software Quality, A frame work for Product Metrics **(Page No.462 471)**

Text Books:

1. V. Rajaraman, Analysis and Design of Information System, Second Edition,PHI
2. Roger S Pressman, Software Engineering, A practitioner’s Approach Sixth edition. McGrawHill InternationalEdition.

Reference Books:

1. Waman S Jawadekar, Software Engineering Principles and Practice, Tata McGrawHill, Ian Sommerville, Software Engineering, Ninth Edition,Pearson

OPERATING SYSTEMS
(COMMON FOR CSE & IT)

IT223	**Credits:4**
Instruction: 4 Periods & 1Tut/week	Sessional Marks:40
End Exam:3Hours	End Exam Marks:60

Prerequisite:
Knowledge in Computer Organization.

Course Objectives:

- Understand Functions, Services and structure of OperatingSystems.
- Understand processes, threads, schedulers and explanation of CPUscheduling.
- Understand issues related to Process Synchronization and focus on principles of Deadlock and relatedproblems
- Comprehend the mechanisms used in Memory Management and VirtualMemory.
- Understand the concepts of File System, secondary storage management and Disk Scheduling

Course Outcomes:

After completion of this course, a student will be able to :	
1	Analyze basic concepts of operating system and their structures
2	Analyze various issues related to inter process communication like process scheduling, resource management and deadlocks
3	Interpret the issues and challenges of memory management.
4	Synthesize the concepts of I/O management, file system implementation and problems related to security and protection

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	1	2	3	1					1	2	3	3	3
	2	3	1	2	2				2	2		1	1	1	3
	3	3	2	2	1	2			3	2		1	2	2	3
	4	2	2	1	1	2		1	2	1		1	2	2	3

SYLLABUS

UNIT– I **14Periods**

INTRODUCTION TO OS

Introduction to operating systems – operating system structures – system calls – system structure – virtual machines.

PROCESS MANAGEMENT

Processes: Process concept – Process scheduling – Operations on processes –Cooperating processes – Interprocess communication. Multi threaded programming. Communication in client server systems. Multi Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues.

UNIT– II **14Periods**

PROCESS SCHEDULING AND SYNCHRONIZATION

CPU Scheduling: Scheduling criteria – Scheduling algorithms – Multiple processor scheduling – Real time scheduling – Algorithm Evaluation. Process Synchronization: The critical section problem –Synchronization hardware – Semaphores – Classic problems of synchronization – critical regions – Monitors. Deadlock: System model – Deadlock characterization –Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance, Deadlock detection – Recovery from deadlock.

UNIT– III **12Periods**

MEMORY MANAGEMENT

Memory Management: Background – Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging. Virtual Memory: Background – Demand paging – Process creation – Page replacement – Allocation of frames – Thrashing.

UNIT– IV **10Periods**

FILE SYSTEMS AND ITS IMPLEMENTATION

File System Interface: File concept – Access methods – Directory structure – File system mounting – Protection. File System Implementation : Directory implementation – Allocation methods – Free space management – efficiency and performance – recovery – log structured file systems.

UNIT– V **14Periods**

SECONDARY STORAGE STRUCTURES AND PROTECTION

Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability Basedsystems.

CASE STUDY(Not considered in the examination): THE LINUX OPERATING SYSTEM: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory management; File systems, Input and output; Inter process communication

Text Book:

1. Silberschatz, Galvin, and Gagne, “Operating System Concepts”, Sixth Edition, Wiley India Pvt Ltd, 2003.

Reference Books:

1. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education, 2004.
2. Gary Nutt, “Operating Systems”, Third Edition, Pearson Education,2004.
3. Harvey M. Deitel, “Operating Systems”, Third Edition, Pearson Education,2004.

PROBABILITY STATISTICS & QUEUING THEORY

IT224 **Credits:4**

Instruction: 4 Periods & 1Tut/week Sessional Marks:40

End Exam:3Hours End Exam Marks: 60

Prerequisite:

Engineering Mathematics 1, 2 & Discrete Mathematical Structures.

Course Objective:

- The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Understand the concepts of various statistical measures like mean, variance and standard deviation of a random variable.
2.	Familiarize the different types probability distributions and their properties.
3.	Compute simple correlation between the variables and fit straight line, parabola by the principle of least squares.
4.	Analyze the statistical data and apply various small or large sample tests for testing the hypothesis.
5.	Learn about different Queuing models and its applications

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3									3		3	3
	2	2	3									3		2	3
	3	3	3									3		3	3
	4	3	3									3		2	2
	5	3	3									3		2	2

SYLLABUS

UNIT – I: PROBABILITY &MATHEMATICAL EXPECTATIONS 12Periods

Introduction to probability: Definition of Random Experiment, Events and Sample space, Definition of probability, Addition and Multiplication theorems, Conditional probability, Baye's Theorem, Simple Problems on Baye's theorem. Random Variables: Discrete and Continuous random variables, Distribution function of random variable, Properties, Probability mass function, Probability density function, Mathematical expectation, Properties of Mathematical expectations, Mean andVariance.

UNIT – II:PROBABILITY DISTRIBUTION 14Periods

Discrete Distributions: Binomial Distribution, Mean and Standard Deviations of Binomial Distribution, Poisson distribution, Mean and Standard Deviations of Poisson Distribution, Applications. Continuous Probability Distributions: Uniform Distribution, Exponential Distribution, Normal Distribution, Properties of Normal Distribution, Importance of Normal Distribution, Area properties of Normal curve.

UNIT – III: CURVE FITTING , CORRELATION AND REGRESSION 10Periods

Curve Fitting: Principle of Least Squares, Method of Least Squares (Straight Line and Parabola).

Correlation: Definition, Measures of correlation, Correlation for Bivariate Distribution, Rank correlation coefficients.

Regression: Simple linear regression, regression lines and properties.

UNIT – IV: TESTING OF HYPOTHESIS 14Periods

Formulation of Null Hypothesis, Critical Region, Level of Significance.

Small Samples: Students t distribution (Significance test of a sample mean, Significance test of difference between sample means),F distribution, χ^2test, Goodness offit.

Large samples: Test of Significance of Large Samples – Single Proportion, Difference between two Proportions, Single mean and Difference of means.

UNIT – V:QUEUEINGTHEORY 10Periods

Queue description, characteristics of a queuing model, study state solutions of M/M/1: α Model, M/M/1; N Model.

TEXT BOOK:

1. T. Veerarajan, Probability, Statistics and Random Processes, Tata McGraw Hill Publications.

REFERENCE BOOKS:

1. Kishore S. Trivedi ,Probability& Statistics with Reliability, Queuing and Computer Applications , Prentice Hall of India ,1999.

COMPUTER GRAPHICS & MULTIMEDIA

IT225 **Credits:3**

Instruction: 3 Periods & 1Tut/week Sessional Marks:40

End Exam:3Hours End Exam Marks:60

Prerequisite:

Computer fundamentals, C programming.

Course Objective:

- This course provides an introduction to the principles of computer graphics. In particular, the course will consider methods for modeling 2 dimensional & 3 dimensional objects and efficiently generating photorealistic renderings on color raster graphics devices. The emphasis of the course will be placed on understanding how the various elements that underlie computer graphics (algebra, geometry, algorithms and data structures, optics, and photometry) interact in the design of graphics software systems.

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Apply output primitive algorithms for drawing line, circle, ellipse and filled area primitives and transformation on 2D objects
2.	Design and Model objects characteristics using 3D representations and apply transformations on 3D objects.
3.	Design multimedia system architecture for multimedia applications using multimedia technologies digital voice and audio, video image and animation
4.	Construct 2D and 3D multimedia building blocks for developing multimedia applications.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3							1	1	1		1	2	3
	2	1	2	3					1	1	1		1	2	3
	3	1	2	3					1	1	1		1	2	3
	4	3							1	1	1		1	2	3

SYLLABUS

UNIT – I:OUTPUTPRIMITIVES **10hours**

Introduction Line Circle and Ellipse Drawing Algorithms – Attributes – Two Dimensional Geometric Transformations – Two Dimensional Clipping and Viewing.

employability

UNIT – II: THREEDIMENSIONALCONCEPTS **8hours**

Three Dimensional Object Representations – Three Dimensional Geometric and Modeling Transformations – Three Dimensional Viewing – Color models – Animation.

employability

UNIT III: MULTIMEDIASYSTEMS DESIGN **10hours**

An Introduction – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases.

UNIT – IV: MULTIMEDIAFILEHANDLING **10hours**

Compression & Decompression – Data & File Format standards – Multimedia I/O technologies Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval Technologies.

employability

UNIT –V:HYPERMEDIA **10hours**

Multimedia Authoring & User Interface – Hypermedia messaging Mobile Messaging – Hypermedia message component – Creating Hypermedia message – Integrated multimedia message standards – Integrated Document management – Distributed Multimedia Systems.

employability

Text Books:

1. DonaldHearnandM.PaulineBaker,“ComputerGraphicsCVersion”,Pearson Education, 2003. (UNIT I : Chapters 1 to 6; UNIT 2: Chapter 9 – 12, 15, 16)
2. Prabat K Andleigh and Kiran Thakrar, “Multimedia Systems and Design”, PHI,2003. (UNIT 3 to 5)

Reference Books:

1. Judith Jeffcoate, “Multimedia in practice technology and Applications”, PHI,1998.
2. Foley, Vandam, Feiner, Huges, “Computer Graphics: Principles & Practice”,Pearson Education, second edition 2003.

NETWORKING LAB

IT226 **Credits:2**

Practical:3Periods/Week Sessional Marks:50

End Exam:3Hours End Exam Marks:50

Prerequisite:

Computer Networks Concepts.

Course Objectives:

- The objective of this lab is to introduce students to the design issues that arise in building and using networks and to give students hands on experience with building and using networkservices.
- The practical issues to be stressed include design and installation of LAN, network operating system, setting up a network system such as users and their permissions and rights, groups and domains, adding workstations and sharing of resources across the network

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Understand and identify the various network infrastructure and command needed for network design and troubleshooting.
2.	Understand the basic concepts and functions of Layer 1 (Hubs), Layer 2(Switches and bridges) and Layer 3 (Router).
3.	Understand the building components of network design.
4.	Understand the basic format of known protocols such as TCP, UDP, ICMP..Etc.
5.	Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3				3								3	3
	2	3				3								3	3
	3	3				3								3	3
	4	3				3								3	3
	5	3				3								3	3

LIST OF EXPERIMENTS

I. StudyExperiments: **2 weeksduration**

This study experiments helps the learners to understand certain network components like Hubs, switches, routers, wireless access modems, transmission medium (coaxial cables, twisted pair cables, optical fiber) and several networkingcomponents

1. Study of specifications of latest desktops and laptops
2. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, routersetc.
3. Familiarization with Transmission media and Tools: Co axial cable, UTP Cable, Crimping tool, Connectorsetc.
4. Study of various LAN topologies and their creation using network devices, cables andcomputers
5. Study of Client ServerArchitecture
6. To study LAN using bus, tree, startopology
7. To study pc to pc communication using parallelport
8. To study fiber optics communication
9. To study wireless communication

employability

II. Handson Experiments **8 weeksduration**

This set of experiments helps the learners in gaining expertise in developing and maintaining a certain network which includes setting up a LAN network and maintaining it, configuring routers, switches and firewalls using a certain Hardware components.

1. preparing straight and crosscables.
2. Study of network commands and network configurationcommands
3. Implementation of file and printersharing
4. Designing and implementing Class A, B, and CNetworks
5. Subnet planning and itsimplementation.
6. To configure the IP address for a computer connected to LAN and to configure network parameters of a web browser for the samecomputer.
7. To install any one open source packet capture software like wire sharketc.
8. To configureWLAN
9. To install and configure wireless accesspoints
10. To configure modem of acomputer
11. To configure hub/switch androuter
12. Configuring NetworkNeighborhood.
13. Configuring a router basedfirewall

employability

III. ProgrammingExperiments **5weeks duration**

This set of programming experiments helps the learners in simulating different routing protocols, network topologies and several layered protocols using simulators like NS2 and packet tracing software's

1. Configure a network topology using packet tracing software
2. Configure a network using Distance vector routing protocol using packet tracer software
3. Static routing using packet tracer software
4. DHCP, DNS, HTTP configuration using packet tracer software

employability

Experiments beyond the Syllabus:

1. Developing a VPN network for number of 50 users
2. TCP, UDP protocol simulation using NS2

employability

Reference Books:

1. CCNA Studyguide.

COMPUTER GRAPHICS & MULTIMEDIA LAB

IT227 **Credits:2**

Practical:3Periods/Week Sessional Marks:50

End Exam:3Hours End Exam Marks:50

Prerequisite:

Computer Graphics & Multimedia Concepts.

Course Objective:

- The computer graphics and multimedia laboratory is established for the purpose of providing working area for development of computer graphics andmultimedia

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Draw various types of lines and curves.
2.	Create animations using various editing tools
3.	Use audio, video, internet editing tools to develop multimedia applications

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	3	3	3					3		3	3	3
	2	3	3	3	3	3					3		3	3	3
	3	3	3	3	3	3					3		3	3	3

LIST OF EXPERIMENTS

1. To implement Bresenham's algorithms for line, circle and ellipsedrawing
2. To perform 2D Transformations such as translation, rotation, scaling, Reflection and sharing.

employability

3. To implement Cohen–Sutherland 2D clipping and window – viewportmapping
4. To perform 3D Transformations such as translation, rotation andscaling.
5. User Interface Design & Graphics II: Create a user interface for your final project. Include 2 backgrounds and 1 button set. Aim for a cohesivelook.
6. Multimedia Sound: Create 2 soundtracks and 2 EFX sounds for a previousproject.
7. Procedure to create an animation to indicate a ball bouncing onsteps
8. Procedure to simulate movement of acloud.

employability

9. Procedure to create an animation with the following features: WELCOME Letters should appear one by one the fill color of the text should change to a different color after the display of the fullword.
10. Procedure to create an animation to represent the growingmoon

employability

11. Procedure to extract the flower only from given photographic image and organize it on a background. Selecting your own background fororganization.
12. Procedure to use appropriate tool(s) from the toolbox cut the objects from 3 files (f1.jpg, f2.jpg & f3.jpg); organize them in a single file and apply feathereffects.

Reference Books:

1. Vaughan, T. “Multimedia – Making it work (5th edition)”, McGrawHill.
2. Boyle, T. “Design for Multimedia Learning”, Prentice Hall, 1997.

OPERATING SYSTEMS (LINUX) LAB

IT228 **Credits:2**

Practical:3Periods/Week Sessional Marks:50

End Exam:3Hours End Exam Marks:50

Prerequisite:
Operating System Concepts.

Course Objectives:

- Analyze the working of an operating system, its programming interface and filesystem.
- Develop algorithms for process scheduling, memory management, pagereplacement algorithms and diskscheduling

Course Outcomes:

After completion of this course, a student will be able to :	
1.	Implement schedulling algorithms, deadlock management.
2.	Implement free space managent and page replacement strategies.
3.	Implement file allocation methods and disk schedulling algorithms.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	3	3		3	2	3			3			3	3
	2	3	3	3		3		2	2		3		3	3	3
	3	3	3	3		3		2	2		3		3	3	3

List of Experiments:

1. Shell Programming & AWKscripts

Employab

2. Write programs using the following system calls of LINUX operating system: Fork, exec, getpid, exit, wait, close, stat, opendir,readdir
3. Write programs using the I/O system calls of LINUX operating system (open, read, write, etc) and error reporting usingerrno
4. Write C programs to simulate UNIX commands like ls, grep,etc.
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for scheduling algorithms FCFS,SJF, PRIORITY & RR. For each of the scheduling policies, compute and print the average waiting time, average turnaround time and Gantt chart
6. Implement the Producer – Consumer problem using semaphores (using LINUX system calls).
7. Programs usingpipes
8. Implement Banker's algorithm for handlingdeadlock
9. Implement free space management strategies such as First fit, Best fit and Worstfit
10. Implement page replacement algorithms such as FIFO,LRU
11. Implement file allocation techniques (Linked, Indexed and Contiguous)

Employab

12. Implement disk arm scheduling algorithms such as FCFS,SSTF

Reference Books:

1. Sumitabha Das, UNIX AND SHELL PROGRAMMING, Tata Mcgraw Hill Publishing CoLtd
2. YashwanthKanetkar , UNIX shell programming, BPBpublications
3. W. Richard Stevens, Stephen A.Rago , Advanced programming in the UNIX environment", 3rd Edition Pearsoneducation.
4. Silberschatz,Galvin,andGagne,“OperatingSystemConcepts”,SixthEdition,Wiley India Pvt Ltd, 2003.

DATABASE MANAGEMENT SYSTEMS

IT312 **Credits: 3**

Instruction: 3 Periods & 1 Tut/Week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Fundamentals of computers, knowledge in any program language

Course Objectives:

- ☐ Understand basic database concepts, including the structure and operation of the relational data model.
- ☐ Construct simple and moderately advanced database queries using Structured Query Language (SQL).
- ☐ Understand and successfully apply logical database design principles, including E-R diagrams and database normalization.
- ☐ Understand the concept of a database transaction and related database facilities, including concurrency control, backup and recovery, locking and protocols.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Design the database system for the database application using the ER model.
2.	Construct Relational Model from ER Model and formulate queries using SQL for extracting information from database.
3.	Optimize the database design by applying normalization principles on databases
4.	Examine the serilizability of non serial schedules, and database recovery using ARIES and compare the different concurrency control protocols.

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3					1	1	1		1	3	2
CO2	1	2	3	1				1	1	1		1	3	2
CO3	2	2	3	2				1	1	1		1	3	2
CO4	2	3	1					1	1	1		1	3	2

SYLLABUS

UNIT-I: **10 Periods**

Introduction to DBMS: Overview, File system vs. DBMS, Advantages of DBMS, Structure of DBMS, Levels of Data Abstraction, Database Users and Administrators,

E-R model: Entities, Attributes and Entity sets, Relationship and Relationship sets, Features of ER model, Conceptual database design with ER model.

employability

UNIT-II: **8 Periods**

Relational model: Integrity constraints over relations and enforcement, Querying relation data, Logical database design, views, destroying/altering tables and views. Relational Languages: algebra and calculus

UNIT-III: **10 Periods**

SQL: Basic SQL, Query, union, interest, except, Nested Queries, Aggregated Operation, Null values, Embedded SQL, cursors, Database connectivity(ODBC and JDBC), Triggers and Active database, designing active databases

employability

UNIT-IV: **10 Periods**

Normalization: Introduction To Schema Refinement - Problems Caused By Redundancy, Decomposition, Functional Dependency, Closure of a Set of FDs, Normal forms(First, Second, Third normal forms, BCNF, Fourth & Fifth normal forms)

employability

UNIT-V: **10 Periods**

Transaction management: Transaction concept, transactions and schedules, concurrent execution of transactions Concurrency control: Lock management, specialized locking techniques, concurrency control without locking Crash Recovery: Aries, recovering from a system crash

Text Books:

1. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw-Hill, 2003.

Reference Books:

1. Silberschatz, Korth and Sudharshan, "Data Base System Concepts", 5th Edition, McGrawHill, 2006.
2. Elmasri, Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education, 2007.

UNIX NETWORK PROGRAMMING

IT313 **Credits: 3**

Instruction: 3 Periods & 1Tut/Week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Fundamentals of Computer Networks, C Programming language

Course Objectives:

- Introduce Network Programming covering TCP, and UDP connections
- Explain Socket programming to design client- server environment
- Explain inter process communication consisting of pipes, FIFOs, Semaphores and message Queues

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Get familiar with the variety of interfaces and frameworks for network applications
2.	Get the knowledge of Interfaces, STREAMS, sockets, RPC libraries.
3.	Know the underlying mechanisms to program client-server model.
4.	Using UNIX socket system calls to manage multiple I/O streams

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2			3							3	2	2	3
	2	2			3	1						3	2	3	2
	3	2			3							3	2	2	3
	4	2			3							3	2	2	3

SYLLABUS

UNIT-I: **10 Periods**

Introduction to Network Programming: OSI model, Unix standards, TCP and UDP, TCP connection establishment and termination, Buffer sizes and limitations, Standard Internet services, Protocol usage by common internet applications.

UNIT-II: **10 Periods**

Sockets: Address structures, Value – result arguments, Byte ordering and manipulation functions and related functions. Elementary TCP sockets – socket, connect, bind, listen, accept, fork and exec functions, concurrent servers, close function and related functions.

UNIT-III: **10 Periods**

TCP Client Server example: Introduction, TCP Echo server and client functions, Normal startup and Termination, Signal handling, Server process termination, Crashing and Rebooting of server host, Shutdown of server host. I/O MULTIPLEXING: I/O Models, select function, Batch input, shutdown function, poll function, TCP Echo server.

Employability

UNIT-IV: **10 Periods**

Elementary UDP sockets: Introduction, recvfrom and sendto functions, UDP Echo server and client functions, Lost datagrams, Lack of flow control with UDP, determining outgoing interface with UDP, TCP and UDP echo server using select.

Elementary name and address conversions: DNS, gethostbyname function, Resolver option, gethostbyname2 function and IPV6 support, uname function, getserverbyname and getservbyp

Employability

functions, other networking information.

Employability

UNIT-V: **8 Periods**

IPC: Introduction, File and record locking, Pipes, FIFOs, streams and messages, Message queues, Semaphores, Shared memory.

Remote login: Terminal line disciplines, Pseudo-Terminals, Terminal modes, Control Terminals, RPC Transparency Issues.

Employability

Text Books:

1. W.Richard Stevens, UNIX Network Programming Sockets API, Volume I, 3rd Edition, PHI, 2010.

Employability

Reference Books:

1. T Chan, UNIX Systems Programming using C++, 1st Edition, PHI, 2010.
2. Graham Glass, King abls, UNIX for Programmers and Users, 3rd Edition, Pearson Education, 2010.
3. M.J. Rochkind, Advanced UNIX Programming, 2nd Edition, Pearson Education, 2008

FORMAL LANGUAGES AUTOMATA THEORY

IT314 **Credits: 4**

Instruction: 4 Periods & 1 Tut /Week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisites: The students are expected to have a strong background in the fundamentals of discrete mathematics (symbolic logic, set, induction, number theory, summation, series, combinatorics, graph, recursion, basic proof techniques, etc.), algorithms and data structures

Course Objectives:

- ☐ Understand basic properties of formal languages and formal grammars.
- ☐ Understand basic properties of deterministic and nondeterministic finite automata
- ☐ Understand the relation between types of languages and types of finite automata
- ☐ Understanding the Context free languages and grammars, and also Normalizing CFG.
- ☐ Understanding the minimization of deterministic and nondeterministic finite automata.
- ☐ Understand basic properties of Turing machines and computing with Turing machines.
- ☐ Understand the concept of Pushdown automata and its application.
- ☐ Know the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard

Course outcomes:

After completion of this course, a student will be able to:	
1.	Analyze Regular, context free, context sensitive and recursively enumerable languages using Chomsky hierarchy grammars (Type-0, 1, 2, 3) based on production parameters.
2.	Discriminate the Regular grammar and context free grammar using G=(N,∑,P,S) and reconstruction of grammars based on production parameters.
3.	Design Finite automata, Pushdown automata and Turing machine for a given regular, context free and unrestricted grammar.
4.	For a given grammar, predict whether the grammar is regular or context free using pumping lemma and check whether they are closed under union, concatenation and closure. Analyze whether the given recursively enumerable language has a solution or not.

Mapping of course outcomes with program outcomes:

	O1 App	O2 nal	O3 des	O4 inv	PO5 tools	PO6 engg	PO7 prof	PO8 ethics	O9 eam	PO10 comm	O11 con	O12 LL	SO1	SO2
-1	2	3	2		2		1	1				1	2	2
-2	1	2	3	2	2		1	1				1	2	3
-3	2	2	3	3	2	2	1	1			2	1	2	3
-4	1	2	3	2	3	2	1	1			2	1	3	3

SYLLABUS

UNIT I: **14 Periods**

Fundamentals: Set, Representation of set, operations on set, Principle of mathematical induction, Strings**,** Alphabets, languages, operations on strings and languages**.**

Finite Automata and Regular Expressions: Basic Concepts of Finite State Systems, Deterministic and Non-Deterministic Finite Automata, Finite Automata with e-moves, Regular Expressions, Minimization of Finite Automata, Mealy and Moore Machines, Two-Way Finite Automate.

UNIT II: **14 Periods**

Regular Sets & Regular Grammars: Basic Definitions of Formal Languages and Grammars, Regular Sets and Regular Grammars, Closure Properties of Regular Sets, Pumping Lemma for Regular Sets, Decision Algorithm for Regular Sets, Myhill-Nerode Theorem, Minimization of Finite Automata.

UNIT III: **12 Periods**

Context Free Grammars and Languages: Context Free Grammars and Languages, Derivation Trees, Simplification of Context Free Grammars, Normal Forms, Pumping Lemma for CFL, closure properties of CFL‟s, Decision Algorithm for CFL.

Employability

UNIT IV: **12 Periods**

Push Down Automata and Deterministic CFL: Informal Description, Definitions, Push-Down Automata and Context free Languages, Parsing and Push-Down Automata.

UNIT V: **12 Periods**

Turing Machines and Undecidability: Design and Techniques for Construction of Turing Machines, Undecidability of PCP. Chomsky Hierarchy, Regular Grammars, Unrestricted Grammars, Context Sensitive languages, Relationship between classes of languages.

Employability

Text Books:

1. E.Hopcraft & Jeffery D.Ulman, Introduction to Automata Theory, Languages & Computation, J– Narosa Publishing Company.

Reference Books:

1. Mishra & Chandra Sekharan, Theory of Computer Science, PHI.
2. Peter Linz, An Introduction To Formal Languages and Automata, 3e, Narosa Publishing House.

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

IT315 **Credits: 3**

Instruction: 3 Periods & 1 Tut /week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Object oriented concepts, C++ programming

Course Objectives:

- ☐ To understand object oriented programming concepts, and apply them in problem solving.
- ☐ To learn the basics of java Console and GUI based programming.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Analyzeprogramming techniques to implement OOP concepts
2.	Design programs for multithreading and exception handing to create new applications
3.	design programs to implement the concepts of Java Files, collections and database in real time problem solving
4.	Develop GUI Applications

Mapping of course outcomes with program outcomes:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	PSO1	PSO2
CO1	2	2	3	3	3				3		3	2	2	2
CO2	2	3	3	3	3				3		3	2	2	3
CO3	2	3	3	3	3				3		3	3	2	3
CO4	2	3	3	3	3				3		3	3	2	3

SYLLABUS

UNIT-I: **10 Periods**

Introduction: Introduction to Java, JVM, java garbage collector, Command line arguments, classes and objects.

Inheritance: Inheritance hierarchies, super and sub classes, Member access rules, super keyword, preventing inheritance: final classes and methods, the Object class and its methods.

Polymorphism: dynamic binding, method overriding, abstract classes and methods.

Interfaces: Interfaces vs. Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interfaces.

Inner classes: uses of inner classes, local inner classes, anonymous inner classes, static inner classes, examples.

UNIT-II: **10 Periods**

Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Exception handling: Dealing with errors, benefits of execution handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re throwing exceptions, exception specification, built in exceptions, creating own exception subclasses.

EMPLOYABILITY

Multithreading: Difference between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter-thread communication, procedure consumer pattern.

EMPLOYABILITY

EMPLOYABILITY

UNIT-III: **12 Periods**

Collection Framework in Java: Introduction to Java Collections, Overview of Java Collection frame work, Generics, Commonly used Collection classes Array List, Vector, Hash table, Stack, Enumeration, Iterator, String Tokenizer, Random, Scanner, calender and Properties

Files: streams - byte streams, character streams, text input/output, binary input/output, random access file operations, File management using File class.

Connecting to Database: JDBC Type 1 to 4 drives, connecting to a database, querying a database and processing the results, updating data with JDBC.

EMPLOYABILITY

UNIT-IV: **8 Periods**

GUI Programming with Java: The AWT class hierarchy, Introduction to Swing, Swing vs, AWT, Hierarchy for Swing components, Containers - JFrame, JApplet, JDialog, JPanel, Overview of some swing components Jbutton, JLabel, JTextField, JTextArea, simple swing applications, Layout management - Layout manager types - border, grid and flow

EMPLOYABILITY

UNIT –V: **8 Periods**

Event handling: Events, Event sources, Event classes, Event Listeners, Relationship between Event sources and Listeners, Delegation event model, Examples: handling a button click, handling mouse events, Adapter classes.

Applets: Inheritance hierarchy for applets, differences between applets and applications, life cycle of an applet, passing parameters to applets, applet security issues.

EMPLOYABILITY

Text Books:

EMPLOYABILITY

1. Herbet Schidt and Dale Srien, Java Fundamentals - A comprehensive Introduction, TMH.

Reference Books:

1. P.J. Deitel and H.M. Deitel, Java for Programmers, Pearson education
2. P.J. Deitel and H.M. Deitel, Java: How to Program, PHI.

DATABASE MANAGEMENT SYSTEMS LAB

IT316 | **Credits: 2**

Practical: 3 Periods/week | Sessional Marks: 50

End Exam: 3 Hours | End Exam Marks: 50

Prerequisite:
Fundamentals of computers, knowledge in any program language

Course Objectives:

- ☐ Understand basic database concepts, including the table structure and operations on tables.
- ☐ Construct simple and moderately advanced database queries using Structured Query Language (SQL).

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Create and manipulate Relational Database using SQL
2.	Write PL/SQL programs, Triggers and Cursors

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	3	2	3		1	2	2			1		2	3	2
	2	3	2	3					1					3	2

Recommended Systems/Software Requirements:

- ☐ Intel based desktop PC
- ☐ Mysql /Oracle latest version Recommended

LIST OF EXPERIMENTS

employability

1. DDL,DML,TCL, DCL commands
2. Creating users - roles and Granting privileges.
3. Built in functions in oracle (String - Date - Aggregate functions etc.)
4. Implement Integrity Constraints. (Key constraints - Domain constraints)
5. Implementing joins - sub queries - nested and correlated nested queries
6. Design ER Model for a given application & Convert ER model to Relational Model
7. Working with set comparison operators & views
8. Working with aggregate functions, GROUP BY, HAVING clauses
9. Implementing operations using PL/SQL blocks
10. Exception handling

employability

11. Implementing cursors
12. Implementing triggers
13. Implementing functions and stored procedures & functions
14. Implementing packages
15. Implementing the concepts of Rollback - commit and checkpoints
16. Database connectivity

Note: Students must submit database design of a case study.

Reference Books:

1. Raghurama Krishnan, Johannes Gehrke, “Data base Management Systems”, 3rd Edition, TATA McGrawHill, 2008.
2. Silberschatz, Korth, “Data base System Concepts”, 6th Edition, McGraw Hill, 2010.
3. C.J.Date, “Introduction to Database Systems”, 7th Edition, Pearson Education, 2002.

UNIX NETWORK PROGRAMMING LAB

IT317 **Credits: 2**

Practical: 3 Periods/week Sessional Marks: 50

End Exam: 3 Hours End Exam Marks: 50

Prerequisite:

Fundamentals of Computer Networks, C Programming language

Course Objectives:

- ☐ Introduce Network Programming covering TCP, and UDP connections
- ☐ Explain Socket programming to design client- server environment
- ☐ Explain inter process communication consisting of pipes, FIFOs, Semaphores and message Queues

Course Outcomes:

After completion of this course, a student will be able to:	
1.	write, execute and debug c programs which use Socket API
2.	understand the use of client/server architecture in application development
3.	Design reliable servers using both TCP and UDP sockets

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	3	3	3	3	3	3	3	3		3		1	2
	2	3	3		2	3	3	3	3	3		3		3	1
	3	3	3	3	1	3	3	3	3	3		3		3	2

LIST OF EXPERIMENTS

1 Implement the following forms of IPC. a) Pipes b) FIFO employability

2 Implement file transfer using Message Queue form of IPC.

3 Write a Program to create an integer variable using Shared Memory concept andincrement the variable simultaneously by two processes. Use Semaphores to avoid Race conditions. employability

4 Design TCP iterative Client and Server application to reverse the given input sentence.

5 Design TCP concurrent Client and Server application to reverse the given input sentence. employability

6 Design TCP Client and Server application to transfer file.

7 Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call “select”.

8 Design a TCP concurrent Server to echo given set of sentences using Poll functions.

9 Design UDP Client and Server application to reverse the given input sentence. employability

10 Design UDP Client Server to transfer a file.

11 Design using Poll Client Server application to multiplex TCP and UDP requests for converting a given text into upper case.

12 Design a RPC application to add and subtract a given pair of integers. employability

Reference Books:

1. Advance Unix Programming Richard Stevens, Second Edition Pearson Education
2. Advance Unix Programming, N.B. Venkateswarlu, BS Publication

JAVA PROGRAMMING LAB

IT318 **Credits: 2**

Practical: 3 Periods/week Sessional Marks: 50

End Exam: 3 Hours End Exam Marks: 50

Prerequisite:

Object oriented concepts, C++ programming language

Course Objectives:

- To design and apply object oriented programming concepts in problem solving.
- To learn the basics of java Console and GUI based programming.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Demonstrate OOP and Java programming in problem solving
2.	Design programs forreal world problems using Java Files and collections.
3.	Apply multithreading and evaluate exception handing to create new applications
4.	Develop simple and complex UI applications using GUI components and databases.

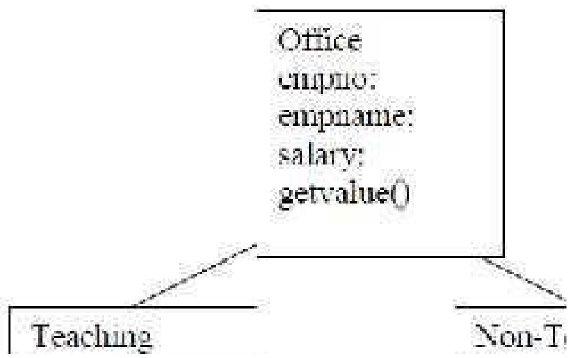
Mapping of course outcomes with program outcomes:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	PSO1	PSO2
CO1	2	2	3	3	3				3	2	3	2	2	2
CO2	2	3	3	3	3				3		3	2	2	3
CO3	3	3	3	3	3				3		3	3	2	3
CO4	2	3	3	3	3				3		3	3	2	3

LIST OF THE EXPERIMENTS

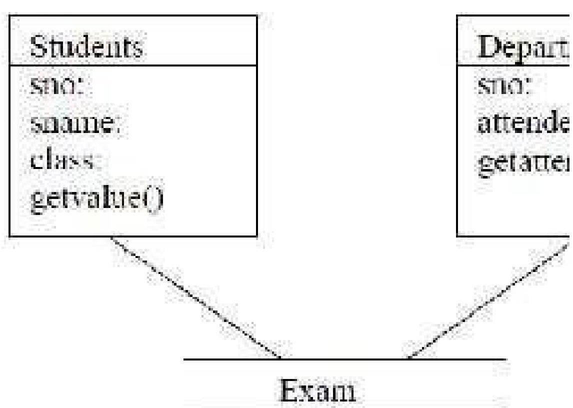
1. Write a java program to calculate gross salary & net salary taking the followingdata.
   Input : empno,empname,basic
   Process: DA=50%of basic
   HRA=25%of basic
   PF=10%of basic
   PT=Rs100/-

2. Write a java program that implements educational hierarchy using inheritance.



3. Write a program to identify the accessibility of a variable by means of different access specifies within and outside package.

4. Write a java program to find the details of the students eligible to enroll for the examination (Students, Department combined give the eligibility criteria for the enrollment class) using interfaces



5. Write a Java program that displays area of different Figures (Rectangle, Square, Triangle) using the method overloading.

6. Write a Java program that displays that displays the time in different formats in the form of HH,MM,SS using constructor Overloading. .
7. Write a Java program that counts the number of objects created by using static variable.
8. Write a Java program to count the frequency of words, characters in the given line of text.
9. Write a Java program for sorting a given list of names in ascending order.
10. Write a Java program that reads a line of integers separated by commas and then displays each integer and fund the sum of he integers (using String Tokenizer)
11. Write a Java program that reads a file name from the user then displays information about whether that file exists, file is writable, the type of file and length of the file in bytes.
12. Write a Java program that reads a file and displays the file on the screen with a line number before each line.
13. Write a Java program that reads a file and displays the no of lines and words in that file.
14. Write a Java program that reads to copy source seat. File and display on the console
15. Write a java program that implements Array Index out of bound Exception using built-in-Exception.
16. Write a java program that implements bank transactions using user denied exception.
17. Write a java program to identify the significance of finally block in handling exceptions.
18. Write a java program to generate multiple threads of creating clock pulses.(using runnable interface)
19. Write a java program to identify the use of synchronized blocks to synchronized methods.
20. Write an applet to display a simple message on a colored background.
21. Write an applet to display a moving banner showing the status of it.
22. Write an applet to draw a simple and beautiful landscape.

EMPLOYABILITY

23. Write a java program to demonstrate key events by using Delegation event model.
24. Write a java program to implement mouse events like mouse pressed, mouse released and mouse moved by means of adapter classes.
25. Write a java program to demonstrate window events on frame.
26. Write an applet that computes the payment of a loan based on the amount of he loan, interest rate and the number of months.

EMPLOYABILITY

27. Write an applet to perform the 4 basic arithmetic operations as buttons in a form accepting two integers in textboxes and display their result.
28. Write a java program to design a registration form for creating a new eMail account.
29. Write a java program to design the page authenticating user name and password by using SWING.
30. Write a java program to design a calculator by using Grid Layout.

EMPLOYABILITY

Reference Books:

1. Herbet Schidt and Dale Srien, Java Fundamentals - A comprehensive Introduction, TMH.
2. P.J. Deitel and H.M. Deitel, Java for Programmers, Pearson education
3. P.J. Deitel and H.M. Deitel, Java: How to Program, PHI.

COMPILER DESIGN

IT321 **Credits: 4**

Instruction: 4 Periods & 1 Tut /Week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Formal Languages and Automata Theory

Course Objectives:

- ☐ Introduce the major concept areas of language translation and compiler design.
- ☐ Develop an awareness of the function and complexity of modern compilers.
- ☐ Provide practical, hands-on experience in compiler design, writing and modification.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Summarize finite automata, regular expressions and analyze compiler architecture.
2.	Analyze lexical analyzer and construct parsers
3.	Analyze symbol table and generate Intermediate code.
4.	Analyze register allocation and Synthesize the code optimization techniques.

Mapping of course outcomes with program outcomes:

	PO												PSO	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	3	2	0	1	0	1	1	1	0	2	2	2
CO2	2	3	3	2	2	1	0	1	1	1	0	2	2	2
CO3	3	2	1	1	1	1	0	1	1	1	0	2	2	2
CO4	2	2	3	2	2	1	0	1	1	1	0	2	2	2

SYLLABUS

UNIT I: **10 Periods**

Overview of language processing: preprocessors, compiler, assembler, interpreters, Linkers & loaders, Basic Concepts of Finite State Systems, Deterministic and Non-Deterministic Finite Automata, Regular expressions, Regular sets and Regular Grammars.

Overall view of Compilers: Brief discussion on various phases of Compilers.

UNIT II: **10 Periods**

Design of lexical analyzer: Lexical Analysis, Role of Lexical Analysis, Lexical Analysis Vs.Parsing, Token, patterns and Lexemes, Lexical Errors, Regular Expressions, Regular definitions for the language Constructs, Strings, Sequences, Comments, Transition diagram for recognition of tokens, Reserved words and identifiers, Examples.

UNIT III: **14 Periods**

Syntax Analysis: Role of a parser, classification of parsing techniques, Top down parsing- First and Follow, LL 1 Grammars, Non-Recursive predictive parsing, Error recovery in Predictive Parsing. Bottom Up parsing- Operator Precedence, Shift Reduce Parsing, Difference between LR and LL Parsers, Construction of SLR parsing tables, CLR parsing tables, LALR parsing tables.

Employability

UNIT IV: **14 Periods**

Semantic analysis: SDT, Postfix notation, parsing tree, Intermediate code, Three address Code, Quadruples, Triples , symbol tables, use of symbol tables. Runtime Environment: storage organization, stack allocation, access to non-local data, heap management, Parameter passing mechanisms

UNIT V: **12 Periods**

Intermediate Code Optimization: The principle sources of optimization, Loop Optimization, DAG, Global data flow analysis.

Code Generation: Problems, Machine model, A simple code generator, Register allocation and assignment, Code generation from DAG, Peep hole optimization

Employability

Text Books:

1. Aho, D. Ullman, Principles of Compiler Design

Reference Books:

1. Kenneth. C. Louden, Compiler Construction, Vikas Pub. House.

DESIGN AND ANALYSIS OF ALGORITHMS

IT322 **Credits: 4**

Instruction: 4 Periods & 1 Tut /week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

C Programming, Data Structures

Course Objectives:

- ☐ Assess how the choice of data structures impacts the performance of programs.
- ☐ Choose the appropriate data structure and algorithm design method for specified problems.
- ☐ Evaluate and Analyze the time complexities for various problems

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Analyze the time complexity of recursive and non-recursive algorithms with respect to the asymptotic order of growth
2.	Design and analyze algorithms to solve optimization problems using Divide and Conquer and Decrease and Conquer.
3.	Design and analyze algorithms to solve optimization problems using Transform and Conquer, Space and Time Tradeoffs, Dynamic Programming and Greedy Techniques.
4.	Reduce one NP-complete problem to another NP-complete problem in polynomial time and analyze polynomial time heuristics to approximate solutions for NP complete problems.

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3						1	1	1		1	3	2
CO2	2	3	3	1				1	1	1		1	3	2
CO3	2	3	3	1				1	1	1		1	3	2
CO4	2	3		1				1	1	1		1	3	2

SYLLABUS

UNIT I: **16 Periods**

Introduction: Fundamentals of algorithmic problem solving – important problem types – fundamental data structures.

Fundamentals of analysis of algorithms and efficiency: Analysis framework – Asymptotic s and BasNotationic Efficiency classes – Mathematical Analysis of Non-recursive Algorithms – Mathematical Analysis of recursive Algorithms.

employability

Brute Force: Selection Sort and Bubble sort – Sequential Search and Brute – Force String Matching – Closest Pair and Convex-Hull Problems by Brute Force – Exhaustive Search.

UNIT II: **12 Periods**

Divide-and-Conquer: Mergesort – Quicksort –Binary Search –Binary Tree Traversals and Related Properties – Multiplication of large integers and Strassen's Matrix Multiplication – Closest-Pair Convex-Hull Problems by Divide-and –Conquer.

Decrease – and – Conquer: Insertion Sort –Depth-First Search and Breadth-First Search - Topological Sorting –Algorithms for Generating Combinatorial Objects – Decrease – by – a – Constant - Factor Algorithms – Variable – Size – Decrease Algorithms.

UNIT III: **12 Periods**

Transform-and-Conquer: Presorting – Gaussian Elimination – Balanced Search Trees – Heaps and Heapsort – Horner's Rule and Binary Exponentiation – Problem Reduction.

Space and Time Tradeoffs: Sorting by Counting, Input Enhancement in string Matching – Horspool's algorithm, Hashing, B-Trees

UNIT IV: **12 Periods**

Dynamic programming: Binomial Coefficient –Warshall's and Floyd's Algorithm–Optimal Binary Search Trees -The Knapsack Problem and Memory Functions. **Greedy Technique**: Prim's Algorithm – Kruskal's Algorithm –Dijkstra's Algorithm –Huffman Trees.

UNIT V: **12 Periods**

Limitations of Algorithm Power: Lower-Bound Arguments –Decision Trees –P, NP, NP hard and NP –complete problems.

Coping with the Limitations of Algorithms Power: Backtracking-n-Queens, Hamiltonian circuit, subset sum problem, –Branch-and-Bound-Assignment, Knapsack, Traveling Salesman problems.

Text Books

1. Anany Levitin, Introduction to Design & Analysis of Algorithms, Pearson Education, NewDelhi, 2003

Reference Books:

1. Thomas H. Corman, Charles E. Leiserson, Ronald R. Rivest & Clifford Stein,Introduction to Algorithms, Prentice Hall of India, New Delhi, New Delhi
2. Aho, Hopcroft & Ullman ,The Design and Analysis of computer Algorithms, PearsonEducation, New Delhi, 2003
3. Gilles Brassard & Paul Bratley,Fundamentals of algorithmics, Prentice Hall of India, New Delhi

OBJECT ORIENTED ANALYSIS AND DESIGN WITH UML

IT323 **Credits: 3**

Instruction: 3 Periods & 1 Tut /Week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Object oriented concepts, C++ programming, Fundamentals of Software Engineering

Course Objectives:

- ☐ Learn the basics of OO analysis and design skills.
- ☐ Learn the UML design diagrams.
- ☐ Learn to map design to code.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Analyze the problem using object oriented concepts like Class, Object, Inheritance, Encapsulation, Abstraction and Polymorphism.
2.	Design class model for the Structure of an object, State model for time and sequence operations, Interaction model to tell the behavior of the system of given project.
3.	Design Interaction modeling by using Use case model, Sequence model and activity model of given project.
4.	Synthesize the application analysis using application Interaction, Class model, state model of a given project.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	2	3	2	3				2	2	2	2	2	2
	2	2	2	3	2	3				2	2	2	2	2	3
	3	2	3	3	2	3				2	2	2	3	2	3
	4	3	3	3	2	3				2	2	2	3	2	3

SYLLABUS

UNIT I: **8 Periods**

Introduction: Object orientation and development, Themes, Evidences for usefulness of OO Development, Modeling History

Modeling as a Design Technique: Modeling, Abstraction, The three models.

Class modeling: Object and class concepts, links and association concepts, generalization and inheritance, a sample class model, navigation of class models

employability

UNIT II: **10 Periods**

Advanced class modeling: Advanced object and class concepts, association ends,N-ary associations,Aggregation, Abstract classes, multiple inheritance, Metadata, Reification, Constraints,derived Data, Packages

State modeling: Events, States, Transitions and conditions,State diagrams, State diagram Behavior.

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Advanced state modeling: Nested state diagrams, nested states, signal generalization, concurrency, a sample state model, relation of class and state models

UNIT III: **10 Periods**

Interaction Modeling: Use Case Model, Sequence models, Activity models EMPLOYABILITY

Advanced Interaction Modeling: Use case relationships, Procedure sequence models, special constructs for Activity Models

Concepts Summary: class Model, State Model, Interaction Model, Relationship among the models

UNIT IV: **10 Periods**

Process overview: Development stages, Development Life cycle EMPLOYABILITY

System conception: Devising a system concepts, elaborating a concept, preparing a problem statement.

Domain Analysis: Overview, domain class model, domain state model, domain interaction model, iterating the analysis

UNIT V: **10 Periods**

Application Analysis: Application Interaction Model, Application class model, Application state model, adding operations

System Design: overview, estimating performance, making a reuse plan, breaking a system into subsystems, identifying concurrency, allocation of subsystems, management of data storage, handling Global resources, choosing a software control strategy, handling boundary conditions, setting trade-off priorities Common architectural styles, architecture of ATM system

Class Design: Overview, bridging a gap, realizing use case, designing algorithms, Recursing downward, refactoring, design optimization, reification of behavior, Adjustment of inheritance, organizing a class design, ATM Example

Text Books:

1. Michael Blaha and James Rumbaugh, Object Oriented Modeling and Design with UML, Prentice Hall India, 2nd Edition.

Reference Books:

1. Grady Booch, Object Oriented Analysis and Design with Applications, Pearson Education Asia
2. Berno Bruegge, Allen H. Dutoit,,Object Oriented Software Engineering - Pearson Education Asia
3. H. Srimathi, H. Sriram, A. Krishnamoorthy, Object Oriented Analysis and Design using UML

MOBILE COMPUTING AND APPLICATION DEVELOPMENT

IT324 **Credits: 3**

Instruction: 3 Periods & 1 Tut /Week — Sessional Marks: 40

End Exam: 3 Hours — End Exam Marks: 60

Prerequisite:

Object oriented concepts, Java Programming, Database Concepts

Course Objectives:

- Understand the basic concepts App Development
- Be familiar with Android system and user interface

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Analyze the fundamentals of Android Operating System & Application Program Skills
2.	Design Layouts, Views and User Interfaces on Android Development IDEs
3.	Apply Database concepts for Android Applications and Interfaces
4.	Develop and publish Mobile applications on Android devices

Mapping of course outcomes with program outcomes:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	PSO1	PSO2
CO1	2	2	3	3	3				3		3	2	2	2
CO2	2	3	3	3	3				3		3	2	2	3
CO3	3	3	3	3	3				3		3	3	2	3
CO4	2	3	3	3	3				3		3	3	2	3

SYLLABUS

UNIT I: **8 Periods**

Introduction To Mobile Apps and Android: Need of Mobile Apps, Different Kinds of Mobile Apps, Android History.

Android Architecture: Overview of Android Stack, Android Features, Introduction to OS layers

Deep Overview in Android Stack: Linux Kernel, Libraries, Android Runtime, Application Framework, Dalvik VM

UNIT II: **10 Periods**

Installing Android Machine: Configuring Android Stack, Setting up Android Studio, Working with Android Studio, Using Older Android Tools

Creating First Android Application: Creating Android Project, Debugging Application setting up environment, AVD Creation, Executing Project on Android Screen

Android Components: Activities, Services, Broadcast Receivers, Content Providers

Hello World App: Creating your first project, The manifest file, Layout resource, Running your app on Emulator

UNIT III: **10 Periods**

Building UI with Activities: Activities, Views, layouts and Common UI components, Creating UI through code and XML, Activity lifecycle, Intents, Communicating data among Activities

Advanced UI: Selection components (GridView, ListView, Spinner), Adapters, Custom Adapters, Complex UI components, Building UI for performance, Menus, Creating custom and compound Views

Notifications: Toast, Custom Toast, Dialogs, Status bar Notifications

Multithreading: Using Java Multithreading classes, AsyncTask, Handler, Post, Writing an animated game

UNIT IV: **10 Periods**

Styles And Themes: Creating and Applying simple Style, Inheriting built-in Style and User defined style, Using Styles as themes

Resources and Assets: Android Resource, Using resources in XML and code, Localization Handling Runtime configuration changes

Intent, Intent Filters and Broadcast Receivers: Role of filters, Intent-matching rules, Filters in your manifest, Filters in dynamic Broadcast Receivers, Creating Broadcast receiver

Receiving System Broadcast: Understanding Broadcast action, category and data, Registering Broadcast receiver through code and through XML, Sending Broadcast

UNIT V: **10 Periods**

Data Storage: Shared Preferences, Android File System, Internal storage, External storage, SQLite, IntroducingSQLite, SQLiteOpenHelper and creating a database, Opening and closing adatabase, Working with cursors Inserts, updates, and deletes.

Content Providers: Accessing built in content providers, Content provider MIME types Searching for content, Adding, changing, and removing content, Creating content provider Working with content files

Multimedia in Android: Multimedia Supported audio formats, Simple media playback, Supported video formats, Simple video playback, Android Application Deployment, Introduction to xamarin

Text Books:

1. Pradeep kothari,Android Application Development (With Kitkat Support), Black Book, Dreamtech publications

Reference Books:

1. Prasant-Pattnaik, Fundamentals of Mobile Computing
2. Padmini, Android App Development: A Complete Tutorial For Beginners
3. Reto Meier, Professional-Android-Application-Development, Wrox Publications

DISTRIBUTED OPERATING SYSTEMS

IT325 (A) **Credits: 4**

Instruction: 4 Periods & 1 Tut /week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Operating Systems, Computer Networks

Course Objectives:

- ☐ Understand foundations of Distributed Systems.
- ☐ Introduce the idea of peer to peer services and file system.
- ☐ Understand in detail the system level and support required for distributed system.
- ☐ Understand the issues involved in studying process and resource management.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Illustrate the fundamentals of distributed systems and networks to design a distributed system
2.	Apply message passing and RPC concepts to provide communication in Distributed Systems
3.	Analyze the implementation of distributed Shared Memory and Synchronization in Distributed Systems
4.	Apply the knowledge of Process and Resource Management on distributed systems
5	Summarize distributed File System and Naming concepts and apply to distributed systems related applications

Mapping of course outcomes with program outcomes:

	PO1 App	O2 nal	PO3 des	PO4 inv	PO5 tools	PO6 engg	PO7 prof	PO8 ethics	O9 eam	PO10 comm	O11 econ	O12 LL	SO1	SO2
-1	**3**	**1**				**1**	**1**		**1**	**1**	**1**	2	3	2
-2	**3**	**2**		**1**		**1**	**1**		**1**	**1**	**1**	**2**	**3**	**2**
-3	**2**	**3**	**1**	**2**		**1**	**1**	**1**	**1**	**1**	**1**	**2**	**3**	**2**
-4	**3**	**2**	**1**	**1**		**1**	**1**	**1**	**1**	**1**	**1**	**2**	**3**	**2**
-5	**2**	**2**	**3**	**2**		**1**	**1**	**1**	**1**	**1**	**1**	**2**	**3**	**2**

SYLLABUS

UNIT I: Fundamentals and networks **10 periods**

Fundamentals: Distributed computing system, evolution, models, popularity, Distributed operating system, design issues, introduction to DCE;

Computer networks: Introduction, Types, LAN, WAN, Communication protocols, Internetworking.

UNIT II: Message passing and RPC **14 periods**

Message passing: Introduction, features, issues in IPC, synchronization, Buffering, multi datagram messages, encoding and decoding, process addressing, failure handling, group communication.

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Remote procedure call: Introduction, RPC model, Transparency of RPC, Implementation, Stub generation, RPC messages, server management, parameter-passing semantics, call semantics, communication protocols, complicated RPC's, Client-Server Binding, exception handling, security, some special types of RPCs, RPC in heterogeneous environments, lightweight RPC.

UNIT III: Distributed shared memory and synchronization **12 periods**
Distributed Shared memory: Introduction, general architecture, design and implementation issues, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing, other approaches to DSM, Heterogeneous DSM, Advantages. **Synchronization:** Introduction, Clock Synchronization, Event ordering, Mutual Exclusion, Deadlock, Election Algorithms.

UNIT IV: Resource management and process management **10 periods**
Resource management: Introduction, Desirable Features of a good global scheduling algorithm, Task assignment approach, load-balancing approach, load-sharing approach. **Process Management**: Introduction, process migration, Threads

UNIT V: Distributed file systems and naming **12 periods**
Distributed file systems: Introduction, features, file models, Accessing models, sharing models, file- caching schemes, file Replication, Fault tolerance, Atomic transactions, design principles. **Naming**: Introduction, features, fundamental terminologies, system-oriented names, object-locating mechanisms, human-oriented names, name caches, naming and security.

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Text Books:

1. pradeep k. Sinha, "Distributed Operating Systems; concepts and design", Edition, Pearson Education,

Reference Books:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
3. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.
4. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003.

TECHNOLOGY MANAGEMENT

IT325 (B) | **Credits: 4**

Instruction: 4 Periods & 1 Tut /week | Sessional Marks: 40

End Exam: 3 Hours | End Exam Marks: 60

Prerequisite:
Fundamentals of computers and Databases

Course Objective: To understand about Information Technology and Information systems, Functional Information systems, DBMS, Disaster Management, Data Mining and Cloud Computing.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Analyze Information systems – Decision Support system, Knowledge Management System, Executive support system, Geographic information system and International Information System.
2.	Analyze data ware house concepts and software development methodologies.
3.	Assess latest business initiatives such as E-Business, E-Governance and cloud computing emerging in the field of information technology.
4.	Determine the concepts related to network security such as error detection, Disaster management and computer crimes.

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**2**	**3**						**1**	**1**	**1**	**2**	**1**	**2**	**1**
CO2	**3**	**3**	**3**	**3**	**3**			**1**	**1**	**1**	**2**	**2**	**2**	**2**
CO3				**2**				**1**	**1**	**1**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**2**	**2**	**2**			**1**	**1**	**1**	**2**	**2**	**2**	**2**

SYLLABUS

UNIT I: **12 Periods**

Introduction - Data, Information, Intelligence, Information Technology, Information System, evolution, types based on functions and hierarchy, Functional Information Systems, DSS, EIS, KMS, GIS, International Information System.

UNIT II: **14 Periods**

Systems analysis and design - Systems development methodologies, Systems Analysis and Design Tools – System flow chart, Decision table, DFD, ER, Object oriented Analysis and Design, UML diagram.

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UNIT III: **14 Periods**

Database management systems - DBMS – HDBMS, NDBMS, RDBMS, OODBMS, Query Processing, SQL, Concurrency Management, Data warehousing and Data Mart

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UNIT IV: **12 Periods**

Security, control and reporting - Security, Testing, Error detection, Controls, IS Vulnerability, Disaster Management, Computer Crimes, Securing the Web, Intranets and Wireless Networks, Software Audit, Ethics in IT, User Interface and reporting.

EMPLOYABILITY

UNIT V: **12 Periods**

New it initiatives - Role of information management in ERP, e-business, egovernance, Data Mining, Business Intelligence, Pervasive Computing, Cloud computing, CMM.

EMPLOYABILITY

Text Books:

1. Robert Schultheis and Mary Summer, Management Information Systems – The Managers View, Tata McGraw Hill, 2008.

Reference Books:

1. Gordon Davis, Management Information System: Conceptual Foundations, Structure and Development, Tata McGraw Hill, 7th edition, 2006.
2. Haag, Cummings and Mc Cubbrey, Management Information Systems for the Information Age,McGraw Hill, 2012.
3. Turban, McLean and Wetherbe, Information Technology for Management – Transforming Organisations in the Digital Economy, John Wiley, 6th edition, 2009.
4. Raymond McLeod and Jr. George P. Schell, Management Information Systems, Pearson Education, 2007.
5. James O Brien, Management Information Systems – Managing Information Technology in the E-business enterprise, Tata McGraw Hill, 2010.
6. Corey Schou and Dan Shoemaker, Information Assurance for the Enterprise – A Roadmap to Information Security, Tata McGraw Hill, 2007.
7. Frederick Gallegor, Sandra Senft, Daniel P. Manson and Carol Gonzales, Information Technology Control and Audit, Auerbach Publications, 4th edition, 2012.

SOFTWARE TESTING AND AUTOMATION

IT325 (C) **Credits: 4**

Instruction: 4 Periods & 1 Tut /week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Any programming language, Object oriented concepts, Fundamentals of Software Engineering

Course Objectives:

The objective is to teach the students about Software testing, it helps in finalizing the software application or product against business and user requirements. It is very important to have good test coverage in order to test the software application completely and make it sure that it's performing well and as per the specifications.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Apply software testing knowledge and engineering methods using modern software development
2.	Design Test-cases using testing strategies
3.	Manage incidents and risks within a project using testing and debugging policies
4.	Develop a test tool to support test automation

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	2	3	2	1						3	2	2	3	2
	2	2	3	2	1						3	2	2	3	2
	3	3	2	2	2	2					2	2	3	2	2
	4	2	2	2	2	1					2	3	2	2	2

SYLLABUS

UNIT I: **12 Periods**

Introduction: Testing as an Engineering Activity – Role of Process in Software Quality – Testing as a Process – Basic Definitions – Software Testing Principles – The Tester's Role in a Software Development Organization –Origins of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples –Developer/Tester Support for Developing a Defect Repository.

UNIT II: **13 Periods**

Test case design: Introduction to Testing Design Strategies – The Smarter Tester – Test Case Design Strategies – Using Black Box Approach to Test Case Design Random Testing – Requirements based testing – positive and negative testing – Boundary Value Analysis –

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decision tables - Equivalence Class Partitioning state based testing – cause effect graphing – error guessing - compatibility testing – user documentation testing – domain testing - Using White–Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing - Coverage and Control Flow Graphs – Covering Code Logic – Paths – Their Role in White–box Based Test Design – code complexity testing – Evaluating Test Adequacy Criteria.

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UNIT III: **12 Periods**

Levels of Testing: The Need for Levels of Testing – Unit Test – Unit Test Planning –Designing the Unit Tests- The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests– Integration Test Planning – scenario testing –defect bash elimination -System Testing – types of system testing - Acceptance testing –performance testing - Regression Testing – internationalization testing – Adhoc testing -Alpha – Beta Tests – testing OO systems – usability and accessibility testing

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UNIT IV: **12 Periods**

Test management : People and organizational issues in testing – organization structures for testing teams – testing services -Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management– test process - Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.

UNIT-V: **12 Periods**

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Controlling and monitoring: Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation - Test metrics and measurements –project, progress and productivity metrics – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews – Developing a review program – Components of Review Plans– Reporting Review Results. – Evaluating software quality – defect prevention – testing maturity model

Text books:

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1. Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson education, 2006.
2. Ilene Burnstein, “Practical Software Testing”, Springer International Edition, Chennai, 2003

Reference books:

1. Boris Beizer, “Software Testing Techniques”, Second Edition, Dreamtech,
2. Elfriede Dustin, “Effective Software Testing”, First Edition, Pearson Education, Renu Rajani, Pradeep Oak, “Software Testing – Effective Methods, Tools and Techniques”, Tata McGraw Hill, 2004.

CLIENT SERVER TECHNOLOGIES

IT325 (D) **Credits: 4**

Instruction: 4 Periods & 1 Tut /week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisite:

Computer Networks, Operating Systems

Course Objectives:

- ☐ Students will be able to provide a generalized definition of client-server computing, one not limited to simple distributed database systems.
- ☐ Students will learn the advantages of client-server systems over monolithic systems.
- ☐ Students will provide definitions and explanations for a large number of technical terms and acronyms related to client-server computing.
- ☐ Students will apply the techniques and features of a client/server development language to construct a moderately complex client/server application.
- ☐ Students will apply the concepts learned in this course to the development of client-server applications that are Internet and/or World Wide Web based.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Introduce the client server architecture and fundamentals of distributed systems
2.	Understand applications and computing aspects of client/ server approach
3.	Analyze the hardware and software structure of a client/server model
4.	Understand the categories, classes and environment of server
5	Understand the structural design of server operating systems

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	2	3	2	1						3	2	2	1
	2	1	2	3	2	1						3	2	2	2
	3	3	3	2	2	2	2					2	2	2	3
	4	2	2	2	2	2	1					2	3	2	3
		3	3	3	2	2	2					2	2	2	3

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UNIT I: **12 Periods**

Introduction to client/server computing-What is client/server computing-Benefits of client/server computing-Evolution of C/S computing-Hardware trends-Software trends-Evolution of operating systems-Networking N/W trends-Business considerations.

UNIT II: **12 Periods**

Overview of C/S Applications: Components of C/S Applications-Classes of C/S Applications-Categories of C/S Applications. Understanding C/S Computing: Dispelling of myths - Obstacles-Upfront &Hidden-Open systems & Standards-Standard-Setting Organizations-Factors for success.

UNIT III: **15 Periods**

The client hardware and software: Client Component-Client operating Systems-what is GUI-Database Access-Client Software Products: GUI Environments –Converting 3270/5250 Screens-Database Tools-Client Requirements-GUI Design Standards-Interface Independence-Testing Interfaces.

UNIT IV: **12 Periods**

The Server: Categories of Servers –Features of Server Machines-Classes of Server machines-Server Environment: N/W Management Environment-N/W computing Environments- Extensions-Network Operating System-Loadable Module.

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UNIT V: **13 Periods**

Server operating system: OS/2. Windows new technology-Unix based OS-Server requirements: Platform independence-Transaction processing-Connectivity-Intelligent database-Stored procedure-Triggers-Load leveling-Optimizer-Testing and diagnostic tools-Backup recovery mechanisms.

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Reference Books:

1. Umar, Amjad-"Object-Oriented Client/Server Internet Environments"- Prentice Hall
2. *Object-Oriented Client/Server Internet Environments*, Amjad Umar, Prentice Hall PTR, Upper Saddle River, New Jersey, 1997

MOBILE COMPUTING AND APPLICATION DEVELOPMENT LAB

IT326 **Credits: 2**

Practical: 3 Practical periods /Week Sessional Marks: 50

End Exam: 3 Hours End Exam Marks: 50

Prerequisite:

Object oriented concepts, Java Programming, Database Concepts

Course Objectives:

- ☐ Understand the basic concepts App Development
- ☐ Be familiar with Android system and user interface

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Analyze the Basic Concepts and Techniques for Creating and DesigningAndroid Applications
2.	Develop and Publish the Android Applications on the Android Devices

Mapping of course outcomes with program outcomes:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	PSO1	PSO2
CO1	2	2	3	3	3				3		3	2	2	2
CO2	3	3	3	3	3				3		3	3	2	3

Requirements:

Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development Tools with appropriate emulators and debuggers

List of Experiments:

1. Installation of mobile application development tool and sample programs
2. Develop an application that uses GUI components, Font and Colors
3. Develop an application that uses Layout Managers and event listeners.
4. Develop a native calculator application.
5. Write an application that draws basic graphical primitives on the screen.
6. Develop an application that makes use of database.
7. Develop an application that makes use of RSS Feed.
8. Implement an application that implements Multi threading
9. Develop a native application that uses GPS location information.
10. Implement an application that writes data to the SD card.
11. Implement an application that creates an alert upon receiving a message.
12. Write a mobile application that creates alarm clock

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Reference Books:

1. Pradeep kothari,Android Application Development (With Kitkat Support), Black Book, Dreamtech publications
2. Prasant-Pattnaik,Fundamentals of Mobile Computing
3. Padmini,Android App Development: A Complete Tutorial For Beginners
4. Reto Meier,Professional-Android-Application-Development,Wrox Publications

Web References:

1. https://developer.android.com/training/basics/firstapp/creating-project.html
2. https://www.tutorialspoint.com/android/android_studio.htm
3. https://www.linuxhelp.com/how-to-install-android-studio-in-ubuntu/

WEB BASED OPEN SOURCE TECHNOLOGIES LAB

IT327 **Credits: 3**

Practical: 3 Periods & 1 Tut /Week Sessional Marks: 50

End Exam: 3 Hours End Exam Marks: 50

Prerequisite:

Object oriented concepts, any programming language.

Course objectives:

- Students will gain the skills and project-based experience needed for entry into web design and development careers.
- Students will be able to use a variety of strategies and tools to create websites.
- Students will develop awareness and appreciation of the myriad ways that people access the web and will be able to create standards-based websites that are accessible and usable by a full spectrum of users.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Analyze the creation of web pages using HTML\XHTML\CSS.
2.	Discover different types of images used in modern webpage along with different functions
3.	Demonstrate web development platforms with display resolutions, viewports & browsers that render websites
4.	Design web pages with development frameworks like Drupal, Bootstrap, Django, web services & Content Management Systems like Joomla
5.	Develop web based application using suitable client side & server side web technologies like Content Management Systems& web services. dents will be able to

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	3				2		2	2	1	3
CO2	3	2	1	1	3				2		2	2	2	2
CO3	3	3	1	2	3				2		2	2	2	3
CO4	3	1	1	2	3				3		3	3	1	3
CO5	3	3	1	2	3				3		3	2	3	3

LIST OF THE EXPERIMENTS TO BE DONE ON THE FOLLOWING TOPICS

1. Introduction EMPLOYABILITY
2. HTML5
3. CSS EMPLOYABILITY
4. PHP
5. Python EMPLOYABILITY
6. Content Management Systems
7. Joomla
8. Drupal
9. Bootstrap EMPLOYABILITY
10. MySql
11. Different types of servers (XAMP, WAMP) EMPLOYABILITY

LIST OF THE EXPERIMENTS.

1. Installation of frame works in different operating systems.
2. Design Registration form using HTML5. EMPLOYABILITY
3. Design Login Form using HTML5.
4. Design and Develop Responsive Website using PHP and MySQl. EMPLOYABILITY
5. Design and Develop Responsive Website using Content Management Systems.

* Each application requires 2 to 3 weeks to finish.

Reference Books:

1. HTML 5 Black book, 2nd edition, Dream tech press.
2. David Sklar, PHP cock book, O'Reilly media, 3rd edition.
3. Luke Welling, PHP & My SQL, SAMS publications, 3rd edition.

COMPUTER AIDED SOFTWARE ENGINEERING TOOLS LAB

IT328 | **Credits: 2**

Practical: 3 Periods /Week | Sessional Marks: 50

End Exam: 3 Hours | End Exam Marks: 50

Prerequisite:

Object oriented concepts, C++ programming, Fundamentals of Software Engineering

Course Objectives:

- ☐ Learn the basics of OO analysis and design skills
- ☐ Be exposed to the UML design diagrams
- ☐ Learn to map design to code
- ☐ Be familiar with the various testing technique

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Design and implement projects using OO concepts
2.	Use the UML analysis and design diagrams
3.	Create code from design and contrast various testing techniques

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	2	3	3	3				3		3	2	2	2
	2	2	3	3	3	3				3		3	2	2	3
	3	2	3	3	3	3				3		3	2	2	3

LIST OF EXPERIMENTS

- To develop a mini-project by following the 9 exercises listed below:
- To develop a problem statement.
- Identify Use Cases and develop the Use Case model.
- Identify the conceptual classes and develop a domain model with UML Class diagram. EMPLOYABILITY
- Using the identified scenarios, find the interaction between objects and represent them using UML Sequence diagrams. EMPLOYABILITY EMPLOYABILITY
- Draw relevant state charts and activity diagrams.
- Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation. EMPLOYABILITY
- Develop and test the Technical services layer.
- Develop and test the Domain objects layer. EMPLOYABILITY
- Develop and test the User interface layer.

SUGGESTED DOMAINS FOR MINI-PROJECT:

- Web Content Management System
- Internet of Things
    - Speech Recognition
    - Enterprise Resource Planning (ERP) based system
    - Online Analytical Processing (OLAP)
    - Online Transaction Processing (OLTP)
    - Information Security
    - Image Processing
    - Automation Systems

*** Any other domain as per student's interest and instructor suggestion**

Suggested Software Tools:

- Rational Suite (or) Argo UML (or) equivalent, Eclipse IDE and Junit
- Visual Paradigm

Reference Books:

1. Grady Booch, the UML user guide.

CRYPTOGRAPHY & NETWORK SECURITY

COURSE IT412 **CREDITS: 3**

Instruction: 3 Periods & 1 Tut /week Sessional Marks: 40M

End Exam: 3 Hours End Exam Marks: 60M

COURSE OBJECTIVE:

1. Learn fundamentals of cryptography and its application to network security.
2. Understand network security threats, security services, and countermeasures. Including basic encryption techniques, cryptographic algorithms, authentication and digital signature, public key infrastructure, access control, security models, as well as their applications to IP security, Web security, trusted operating systems.
3. Understand vulnerability analysis of network security.
4. Acquire background on hash functions; authentication; firewalls; intrusion detection techniques.

COURSE OUTCOMES:

On completing this course student will be able to

CO1 Able to encrypt and decrypt information using some of the standard algorithms

CO2 To develop strategies to protect organization information assets from common attacks.

CO3 Understand how authentication is implemented in wireless systems

CO4 Acquire knowledge on the role of a "professional computing practitioner" with particular regard to an understanding of legal and ethical issues

SYLLABUS

UNIT –I (Text Book -1) **(10 Periods)**

- **Attacks on Computers and Computer Security:** Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security
- **Cryptography: Concepts and Techniques:** Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, stenography, key range and key size, possible types of attacks, Key Distribution, Diffie-Hellman Key exchangealgorithm

UNIT – II (Text Book -1) **(15 Periods)**

- **Symmetric key Ciphers:** Introduction, Algorithm modes and types, An overview of symmetric key cryptography, Algorithms- DES, AES, IDEA,Blowfish,RC4, Differential and Linear Crypt analysis.
- **Asymmetric key Ciphers:** Principles of public key cryp to systems, Algorithms(RSA, Diffie-Hellman, ECC), Key Distribution.

UNIT – III (Text Book -2) **(15 Periods)**

- **Message Authentication Algorithms and Hash Functions:** Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures.
- **Authentication Applications:** Kerberos, X.509 Authentication Service, Public – Key Infrastructure, Biometric Authentication.

UNIT – IV (Text Book -2) **(10 Periods)**

- **E-Mail Security:** Pretty Good Privacy, S/MIME
- **IP Security:** IP security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, keymanagement.

UNIT – V (Text Book -1 & 2) **(10 Periods)**

- **Web Security:** Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction
- **Intruders, virus and Firewalls:** Intruders, Intrusion detection, password management, virus and related threats, Countermeasures, Firewall design principles, types of firewalls
- **Case Studies on Cryptography and security:** Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual E lections

Text Book:

I. William Stallings, Cryptography And Network Security, 4th Edition, (Pearson Education/PHI).

II. Cryptography and Network security, Atul Kahate, Tata McGraw-Hill Pub company Ltd., New Delhi

Reference Books:

I. Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi

II. Network Security Essentials Applications and Standards, William Stallings, Pearson Education, New Delhi

III. Network Security: The Complete Reference by Roberta Bragg, Mark Phodes-Ousley, Keith Strassberg Tata Mcgraw-Hill

IT413 **DATA ANALYTICS** **CREDITS: 3**

Instruction: 3 Periods & 1 Tut /week Sessional Marks: 40
End- Exam: 3 Hours End-Exam-Marks: 60

Course Objectives:

1. Optimize business decisions and create competitive advantage with Big data analytics
2. Explore the fundamental concepts of big data analytics and Hadoop Platform
3. Understand the applications using the Map Reduce concepts
4. Introduce programming tools such as PIG and HIVE in Hadoop Ecosystem

Course Outcomes:
On completing this course student will be able to

CO1: Describe the characteristics of big data and demonstrate the Business Implications for Big Data applications using Apache Hadoop Eco system.

CO2: Apply Big data analytics and Hadoop concepts to solve Big Data related challenges.

CO3: Analyze the functioning of of Hadoop Distributed file system (HDFS) and Map Reduce techniques and apply these concepts on large data sets.

CO4: Write queries for big data applications using hive query language to retrieve information.
CO5: Develop pig scripts to retrieve information for big data applications.

Course matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3							1	1	1		1	3	2
CO2	3	2			2			1	1	1		1	3	2
CO3		3	2		2			1	1	1		1	3	2
CO4		3	2		2			1	1	1		1	3	2
CO5		3	2		2			1	1	1		1	3	2

UNIT I (10 Periods)

Classification of Digital Data : Characteristics of Data, Evolution of Big Data, Definition of Big Data,Challenges with Big Data, Big Data and Other Characteristics of Data Which are not Definitional Traits of Big Data, purpose of Big Data, Information Consumer versus Produce Information, Traditional Business Intelligence (BI) versus Big Data, A Typical Data Warehouse Environment ,A Typical Hadoop Environment ,co existence of Big Data and Data warehouse changes in the Realms of Big Data

UNIT II (10 Periods)

Big Data Analytics and Hadoop : Classification of Analytics, Greatest Challenges that Prevent Businesses from Capitalizing on Big Data, Top Challenges Facing Big Data, Importance of Big Data Analytics , Kind of Technologies to Meet the Challenges Posed by Big Data , Data Science ,Data Scientist, Terminologies Used in Big Data Environments, Basically Available Soft State

Employability

Eventual Consistency (BASE) ,Few Top Analytics Tools
The Big Data Technology Landscape : NoSQL (Not Only SQL) , Hadoop

UNIT III (10 Periods)

Introduction to Hadoop : Introducing Hadoop , RDBMS versus Hadoop, Distributed Computing Challenges , History of Hadoop, Hadoop Overview, Use Case of Hadoop, Hadoop Distributors ,HDFS (Hadoop Distributed File System),Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator),Interacting with Hadoop Ecosystem

Employability

Employability

Introduction to MAPREDUCE Programming : Introduction ,Mapper , Reducer ,Combiner ,Partitioner , Searching , Sorting , Compression

Employability

UNIT IV (8 Periods)

Introduction to Hive : Hive and Hive Architecture, Hive Data Types, Hive File Format ,Hive Query Language (HQL) , RCFile Implementation ,SerDe , User-Defined Function (UDF)

UNIT V (10 Periods)

Employability

Introduction to Pig : Pig and Anatomy of Pig ,Pig on Hadoop ,Pig Philosophy ,Use Case for Pig: ETL Processing ,Pig Latin Overview ,Data Types in Pig ,Running Pig , Execution Modes of Pig,HDFS Commands ,Relational Operators , Eval Function ,Complex Data Types, Piggy Bank User-Defined Functions (UDF) ,Parameter Substitution ,Diagnostic Operator , Word Count Example using Pig , When to use Pig?, When not to use Pig? , Pig at Yahoo!, Pig versus Hive

Employability

Textbooks:

1. Seema Acharya and Subhashini Chellappan , Big Data and Analytics , Wiley publication

Reference Books:

1. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch ,“Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data”, 1st Edition, TMH,2012.
2. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O’reilly

ARTIFICIAL INTELLIGENCE & ROBOTICS

COURSE IT414 (A) **CREDITS: 4**

Instruction: 4 Periods & 1 Tut /week Sessional Marks: 40M

End Exam: 3 Hours End Exam Marks: 60M

COURSE OBJECTIVE:

This course has been designed to:

- Explain how heuristics offer ways to pursue goals in exponentially large search spaces
- Describe the representation and use of knowledge in inference-based problem solving by knowledge-based agents
- Apply probability theory to describe and model agents operating in uncertain environments
  - Describe ways to supervise agents to learn and improve their behavior
  - Explain adaptive learning from the environment
  - Relate theories of mind and the future of AI to ethical issues raised by artificial cognitive systems

COURSE OUTCOMES:

On completing this course student will be able to

CO1 Distinguish the concepts of State Space and Heuristic Search Algorithms.

CO2 Solve problems in propositional logic, predicate calculus and other axiomatic systems.

CO3 Identify the role of knowledge representation, problem solving and learning in intelligent systems.

CO4 Differentiate traditional systems ,Rule-based and Expert Systems and examine the working of Neural networks.

CO5 Analyze the framework for keeping track of the positions and velocities of objects in space

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	3	2					1	1	1		1	2	2
CO 2	3	1						1	1	1		1	2	2
CO 3	3	1	2					1	1	1		1	2	2
CO 4	2	3	2	1	1			1	1	1		1	2	2
CO 5	2	3	2	1	1			1	1	1		1	2	2

SYLLABUS

UNIT I: (13 Periods)

Introduction to artificial intelligence: Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI. Problem solving: state-space search and control strategies : Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative-deepening a*, constraint satisfaction.

Employability

UNIT II: (13 Periods) Logic concepts: Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.

UNIT III: (13 Periods)

Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames advanced knowledge representation techniques:

Employability

UNIT IV: (13 Periods)

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems, truth maintenance systems.
Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, Dempster-Shafer theory

UNIT V: (TextBook 2) (12 Periods)

Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products, coordinate frames, Rotations, Homogeneous coordinates..

Text Books:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
2. Robert J. Schilling, Fundamentals of Robotics Analysis and Control, PHI Learning., 2009.

Reference Books:

I. Artificial intelligence, structures and Strategies for Complex problem solving, George.F.Lugar, 5th edition, PEA
II. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
III. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

PARALLEL COMPUTING

COURSE IT414 (B) **CREDITS: 4**

Instruction: 4 Periods & 1 Tut /week Sessional Marks: 40M

End Exam: 3 Hours End Exam Marks: 60M

COURSE OBJECTIVE:

This course covers the design of advanced modern computing systems. In particular, the design of modern microprocessors, characteristics of the memory hierarchy, and issues involved in multi-threading and multi-processing are discussed. The main objective of this course is to provide students with an understanding and appreciation of the fundamental issues and tradeoffs involved in the design and evaluation of modern computers

COURSE OUTCOMES:

Understand the concepts and terminology of high performance computing

CO1 Can analyze the need for high performance and parallel programming models.

CO2 Can write and analyze the behavior of high performance parallel programs for distributed memory architectures (using MPI).

CO3 Can write and analyze the behavior of high performance parallel programs for shared memory architectures (using Pthreads and OpenMP).

CO4 Can write simple programs for the GPU.

SYLLABUS

UNIT I: **(12 Periods)**

Introduction to Parallel hardware and software, need for high performance systems and Parallel Programming, SISD, SIMD, MISD, MIMD models, Performance issues.

employability

UNIT II: **(12 Periods)**

Processors, PThreads, Thread Creation, Passing arguments to Thread function, Simple matrix multiplication using Pthreads, critical sections, mutexes, semaphores, barriers and conditional variables, locks, thread safety, simple programming assignments.

employability

UNIT III: **(12 Periods)**

Open MP Programming: introduction, reduction clause, parallel for-loop scheduling, atomic directive, critical sections and locks, private directive, Programming assignments, n body solvers using openMP.

employability

UNIT IV: **(12 Periods)**

Introduction to MPI programming: MPI primitives such as MPI_Send, MPI-Recv, MPI_Init, MPI-Finalize, etc., Application of MPI to Trepizoidal rule, Collective Communication primitives in MPI, MPI derived datatypes, Performance evaluation of MPI programs, Parallel sorting algorithms, Tree search solved using MPI, Programming Assignments.

employability

UNIT V: **(14 Periods)**

Introduction to GPU computing, GPUs as Parallel Computers, Architecture of a Modern GPU Graphics pipelines, GPGPU, Data Parallelism and CUDA C Programming, CUDA Threads Organization, Simple Matrix multiplication using CUDA, CUDA memories.

employability

Text Books:

1. An Introduction to Parallel Programming, Peter S Pacheco, Elsevier, 2011
2. Programming Massively Parallel Processors A hands-on Approach By David B. Kirk and Wen-mei W. Hwu, Morgan Kaufmann, 2010.
3. Programming Massively Parallel Processors, Kirk & Hwu, Elsevier, 2012

Reference Books:

I. CUDA by example: An introduction to General Purpose GPU Programming, Jason, Sanders, . Edward Kandrit, Perason, 2011
II. CUDA Programming, Shame Cook, Elsevier
III. High Performance Heterogeneous Computing, Jack Dongarra, Alexey & Lastovetsky, Wiley
IV. Parallel computing theory and practice, Michel J.Quinn, TMH

DATA WARE HOUSING AND MINING

COURSE IT414 (C) | **CREDITS:**
Instruction: | Sessional Marks: 40M
End Exam: 3 Hours | End Exam Marks: 60M

COURSE OBJECTIVE:

1. To introduce the basic concepts of Data Warehouse and Data Mining techniques.
2. Examine the types of the data to be mined and apply preprocessing methods on raw data.
3. Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

COURSE OUTCOMES:

Students who complete this course should be able to:

CO1. Apply Data Preprocessing steps Data Cleaning, Data Transformation and Data reduction on the given data set to ensure that the data is correct, consistent and usable.

CO2. Design Datawarehouse for a given database application using starnet schema, fact constellation schema and snowflake schema.

CO3. Analyze the data and describe the concepts using Concept Description and discrimination and attribute relevance analysis. Analyze and discover the associations in the given data using Association Rule Mining algorithms: Apriori and FP Growth.

CO4. Analyze the data and predict the outcome using classification techniques: Bayesian Classification, Backpropogation, Decision Tree and Clustering Algorithms: K-Means on the given dataset

SYLLABUS

UNIT I: **(14 Periods)**

Introduction to Data Mining: Motivation and importance, What is Data Mining, Relational Databases, Data Warehouses, Transactional Databases, Advanced Database Systems and Advanced Database Applications, Data Mining Functionalities,Interestingness of a pattern Classification of Data Mining Systems, Major issues in Data Mining . Data Mining Primitives: What defines a Data Mining Task Architectures of Data Mining Systems. why Pre-process the Data,Data Cleaning, Data Integration and Transformation Data Reduction, Discretization and Concept Hierarchy Generation

UNIT II: **(11 Periods)**

Data Warehouse and OLAP Technology for Data Mining ,What is a Data Warehouse? Multi-Dimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Development of Data Cube Technology, Data Warehousing to Data Mining

Employability

UNIT III: **(11 Periods)**

Concept Description: Characterization and comparison What is Concept Description, Data Generalization and summarization-based Characterization, Analytical Characterization: Analysis of Attribute Relevance, Mining Class Comparisons: Discriminating between different Classes, Mining Descriptive Statistical Measures in large Databases

UNIT IV: **(12 Periods)**

Mining Association rule in large Databases Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Databases,Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint- Based Association Mining

Employability

UNIT V: **(12 Periods)**

Classification and prediction Concepts and Issues regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods.

Employability

Cluster Analysis: What is Cluster Analysis, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning algorithms

Employability

Text Books:

1. Data Mining Concepts and Techniques Jiawei Han and Micheline Kamber Morgan Kaufman Publications

Reference Books:

I. Data Mining Introductory and Advanced Topics, Margaret H Dunhan, Pearson Education.
II. Data Mining, Ian H. Witten Eibe Frank, Morgan Kaufman Publications.
III. Data Mining by Tan, Steinbach, Vipin Kumar, Pearson Education.

SOFTWARE PROJECT MANAGEMENT

COURSE IT414 (D) **CREDITS: 4**

Instruction: 4 Periods & 1 Tut. /Week Sessional Marks: 40M

End Exam: 3 Hours End Exam Marks: 60M

COURSE OBJECTIVE:

1. To outline the need for Software Project Management

2. To highlight different techniques for software cost estimation and activity planning

COURSE OUTCOMES:

Upon the successful completion of the course, students will be able to:

CO1 Understand the principles of software project management

CO2 Demonstrate cost estimation

CO3 Understand risk management and control the project

CO4 Manage the software project

SYLLABUS

UNIT I: **(13 Periods)**

Project evaluation and project planning : Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

EMPLOYABILITY

UNIT II: **(13 Periods)**

Project life cycle and effort estimation : Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern

EMPLOYABILITY

UNIT III: **(13 Periods)**

EMPLOYABILITY

Activity planning and risk management: Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

EMPLOYABILITY

EMPLOYABILITY

EMPLOYABILITY

UNIT IV: **(13 Periods)**

Project management and control : Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management.

EMPLOYABILITY

EMPLOYABILITY

UNIT V: **(12 Periods)**

Staffing in software projects : Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans.

EMPLOYABILITY

Text Books:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

EMPLOYABILITY

Reference Books:

I. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication,2011.
II. Walker Royce: "Software Project Management"- Addison-Wesley, 1998.

MACHINE LEARNING

COURSE IT415 (A) | **CREDITS: 4**
Instruction: 4 Periods & 1 Tut. /Week | Sessional Marks: 40M
End Exam: 3 Hours | End Exam Marks: 60M

COURSE OBJECTIVE:

I. The objective of this course is to give students basic knowledge about the key algorithms and theory that form the foundation of machine learning.
II. Identify and apply the appropriate Machine learning technique to classification, Pattern Recognition, and Optimization and Decision problems.

COURSE OUTCOMES:

Student will be able to

CO 1 Illustrate the steps in the design of learning Systems with an application.

CO 2 Analyze the data and predict decisions using Decision Tree Learning Algorithms.

CO 3 Classify the textual data by using Multiclass Classification Algorithms.

CO 4 Analyze and Formulate Computational Learning Theory for Finite and Infinite hypothesis spaces

CO 5 Describe machine learning paradigms: supervised and unsupervised learning, inductive and deductive learning and case based reasoning and learning.

SYLLABUS

UNIT I: **(13 Periods)**

Introduction: Definition of learning systems, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, Function approximation.

Employability

UNIT II: **(13 Periods)**

Decision Tree Learning: Decision Tree Representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, issues in decision tree learning.

Employability

UNIT III: **(13 Periods)**

Bayesian Learning: Bayes Theorem and concept learning, Maximum likelihood and least squared error hypothesis, Maximum likelihood hypothesis for predicting probabilities, Bayes optimal classifier, Naive Bayes classifier, An example to classify text, Bayesian belief networks.

Employability

Employability

UNIT IV: **(13 Periods)**

Computational Learning Theory: Probability learning an approximately correct hypothesis, Sample complexity for finite hypothesis spaces, Sample complexity for infinite hypothesis spaces.

Instance-Based Learning: Constructing explicit generalizations versus comparing to past specific examples, K-Nearest-neighbor algorithm, Case-based learning.

Employability

UNIT V: **(12 Periods)**

Machine learning paradigms: Introduction, machine learning systems, supervised and unsupervised learning, inductive learning, deductive learning, clustering, Support vector machines, Case based reasoning and learning.

Employability

Employability

Text Books:

1. Machine Learning, Tom M.Mitchell, MGH

Reference Books:

I. Introduction to machine Learning, 2nd ed, Ethem Alpaydin, PHI

II. Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press.

III. Kearns, M. and Vazirani, U. (1994). Computational Learning Theory. Cambridge, MA: MIT Press.

STORAGE AREA NETWORKS

COURSE IT415 (B) **CREDITS: 4**

Instruction: Sessional Marks: 40M

End Exam: 3 Hours End Exam Marks: 60M

COURSE OBJECTIVE:

Ability to demonstrate storage area networks and their products and to provide the mechanisms for backup/recovery.

COURSE OUTCOMES:

Understand the concepts and terminology of high performance computing

CO 1 Understand Storage Area Networks characteristics and components.

CO 2 Become familiar with the SAN application environment, network storage and topologies

CO 3 Identifying the issues and down time's in relation with the SAN failure

CO 4 Understand the technology related to back up's

CO 5 Analyze and understand the security and monitoring aspects in SAN's

SYLLABUS

UNIT I **(15 Periods)**

Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications.

UNIT II **(10 Periods)**

Concept of RAID and its components , Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems ,High-level architecture and working of an intelligent storage system Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN , Benefits of the different networked storage options, Understand the need for long-term archiving solutions and describe how CAS fulfills the need , Understand the appropriateness of the different networked storage options for different application environments

UNIT III **(10 Periods)**

List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime, Differentiate between business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures.

UNIT IV **(10 Periods)**

Architecture of backup/recovery and the different backup/recovery topologies replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities

UNIT V **(10 Periods)**

Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center. Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain Virtualization technologies, block-level and file-level virtualization technologies and processes.

Text Books:

1. EMC Corporation, Information Storage and Management, Wiley.

Reference Books:

I. Robert Spalding, “Storage Networks: The Complete Reference”, Tata McGraw Hill, Osborne, 2003.

II. Marc Farley, “Building Storage Networks”, Tata McGraw Hill, Osborne, 2001.

III. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.

USER EXPERIENCE(Ux)

COURSE IT415 (C) | **CREDITS: 4**

Instruction: 4 Periods & 1 Tut. /Week | Sessional Marks: 40M

End Exam: 3 Hours | End Exam Marks: 60M

COURSE OBJECTIVE:

COURSE OUTCOMES:

Understand the concepts and terminology of high performance computing

CO 1 analyze users' needs, usability goals and user experience goals of a software application

CO 2 use software prototyping tools to design user interfaces that take into account human capabilities and constraints, users' needs, usability goals

CO 3 implement functional user interface prototypes based on the design process

CO 4 critically evaluate the usability of software application

SYLLABUS

UNIT I **(13 Periods)**

Usability of Interactive Systems: Introduction, Usability Requirements, Usability Measures, Usability Motivations, Universal Usability,

Guidelines, Principles, and Theories: Introduction, Guidelines, Principles, Theories Object-Action Interface, Model

EMPLOYABILITY

Managing Design Processes: Introduction, Organizational Design to Support Usability The Three Pillars of Design, Development Methodologies, Ethnographic Observation, Participatory Design, Scenario Development Social Impact Statement for Early Design Review, Legal issues

UNIT II **(13 Periods)**

Evaluating Interface Designs: Introduction, Expert Reviews, and Usability Testing and Laboratories, Survey Instruments, Acceptance Tests, Evaluation during Active Use, Controlled Psychologically Oriented Experiments

Software Tools: Introduction, Specification Methods, Interface-Building Tools, Evaluation and Critiquing Tools

Direct Manipulation and Virtual Environments: Introduction, Examples of Direct Manipulation, Discussion of Direct Manipulation, 3D Interfaces, Teleoperation, Virtual and Augmented Reality

EMPLOYABILITY

EMPLOYABILITY

UNIT III **(13 Periods)**

Menu Selection, Form Filling, and Dialog Boxes: Introduction, Task-Related Menu Organization, Single Menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, And Data Entry with Menus: Form Filling, Dialog Boxes, And Alternatives, Audio Menus and Menus for Small Displays

Command and Natural Languages: Introduction, Functionality to Support Users Tasks, Command-Organization Strategies, the Benefits of Structure, Naming and Abbreviations, Natural Language in Computing

Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory Interfaces, Displays-Small and Large, Printers

UNIT IV **(13 Periods)**

Collaboration: Introduction, Goals of Collaboration, Asynchronous Distributed Interfaces: Different Time, Different Place Synchronous Distributed Interfaces: Different Place, Same Time Face-to-Face Interfaces: Same Place, Same Time

Quality of Service: Introduction, Models of Response-Time Impacts, Expectations and Attitudes, User Productivity, Variability in Response Time, Frustrating Experiences

Balancing Function and Fashion: Introduction, Error Messages, Non anthropomorphic Design, Display Design, Window Design, Color

EMPLOYABILITY

UNIT V **(12 Periods)**

User Manuals, Online Help, and Tutorials: Introduction, Paper Versus Online Manuals, Reading from Paper Versus from Displays, Shaping the Content of the Manuals, Online Manuals

EMPLOYABILITY

and Help, OnlineTutorials, Demonstrations, and Guides, Online Communities for User Assistance, The Development Process

EMPLOYABILITY

Information Search and Visualization: Introduction, Search in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Search Interfaces, Information Visualization

EMPLOYABILITY

Text Book:

EMPLOYABILITY

1. Ben Sheiderman, "Design The User Interface", Pearson Education, 1998.

Reference Books:

I. Wilbent. O. Galitz ,"The Essential Guide To User Interface Design", John Wiley& Sons, 2001.
Alan Cooper, "The Essential Of User Interface Design", Wiley – Dream Tech Ltd., 2002

INTELLECTUAL PROPERTY RIGHT AND PATENTS

IT 415-4 **Credits: 3**

Instruction: 3 Periods & 1 Tut /week Sessional Marks: 40

End Exam: 3 Hours End Exam Marks: 60

Prerequisite: Not required.

Course Objectives:

- ☐ Understand intellectual property rights and law of copy rights.
- ☐ Procedure to apply various patents for innovative ideas and products.
- ☐ Aware various trade laws in the field of business.

Course Outcomes:

After completion of this course, a student will be able to:	
1.	Understand the importance of Intellectual property rights and its usage.
2.	Know various International laws in trade policies.
3.	Identify the international trade secrets trade secretes litigation
4.	Analyze international trade and copy right laws

SYLLABUS

UNIT I: (Text Book 1) **7 Periods**

Introduction to Intellectual Property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT II: (Text Book 1) **10 Periods**

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT III: (Text Book 1 & 2) **15 Periods**

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights andtransfer

UNIT IV: (Text Book 1) **10 Periods**

Trade Secrets: Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, protection for submission, trade secretes litigation.

Unfair Competition: Misappropriation right of publicity, False advertising

UNIT V: (Text Book 2) **18 Periods**

New development of intellectual property: New developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international-trade mark law, copy right law, international patent law and international development in trade secrets law.

Text Books:

1. Deborah, E. Bouchoux, Cengage learning, Intellectual property right,
2. Prabuddha Ganguli, Intellectual property right – Unleashing the knowledge economy, Tata Mc Graw Hill Publishing Company Ltd.

ANALYTICS LAB

COURSE IT416 **CREDITS: 2**

Instruction: 3 Periods Sessional Marks: 50M

End Exam: 3 Hours End Exam Marks: 50M

COURSE OBJECTIVE:

- Identify Big Data and its Business Implications.
- List the components of Hadoop and Hadoop Eco-System
- Access and Process Data on Distributed File System
- Manage Job Execution in Hadoop Environment

COURSE OUTCOMES:

1. Understand the Big Data Platform and its Use cases
2. demonstrate HDFS Concepts and Interfacing with HDFS
3. use Map Reduce Jobs in various applications
4. Apply analytics on Structured, Unstructured Data.

List of the Experiments

1. *Installing and configuring Hadoop* Employability
2. *Run Hadoop commands*
3. *Data structure implementation in java : LinkedList ,Stack,Queue,Set,Map*
4. *Setting up HDFS and monitoring UI*
5. Implement word count / frequency programs using mapreduce
6. Implement an map reduce program that processes a weather dataset Employability
7. Simple analytics using Map Reduce.
8. Visualize data using any plotting framework
9. Plotting the Hadoop results using GNU plot and Calculating histograms using Map Reduce.
10. Apache Pig installation and running latin scripts

Reference Book:

1. Hadoop Map Reduce Cookbook, Srinath Perera & Thilina Gunarathne, 2013, PACKT
PUB

Employability

.

COURSE IT417 NETWORK SECURITY LAB CREDITS: 2

Instruction: 3 Periods Sessional Marks: 50M
End- Exam : 3 Hours End-Exam-Marks: 50M

COURSE OBJECTIVES:

1) Learn to implement the algorithms DES, RSA,MD5,SHA-1
2) Learn to use network security tools like GnuPG, KFsensor, Net Strumbler

COURSE OUTCOMES:
At the end of the course, the student should be able to:

1) Implement the cipher techniques
2) Develop the various security algorithms
3) Use different open source tools for network security andanalysis

LIST OF EXPERIMENTS:

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:

a) Caesar Cipher
b) Playfair Cipher
c) Hill Cipher

2. Implement the following algorithms
a) DES
b) RSA Algorithm
c) Diffiee-Hellman

3. Implement the Signature Scheme - Digital Signature Standard
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG)
5. Installation of rootkits and study about the variety of options
6. Demonstrate how to test Firewall using any tool(FireHOL , Nmap or any other software)

LIST OF HARDWARE REQUIREMENTS & SOFTWARE REQUIREMENTS

- **SOFTWARE REQUIREMENTS**
  - Java or equivalent compiler
  - GnuPG KF Sensor or Equivalent
  - Snort
  - Net Stumbler or Equivalent
  - FireHOL
  - Nmap

- **HARDWARE REQUIREMENTS**

  Standalone desktops (or) Server supporting 30 terminals or more

SOFT COMPUTING

COURSE IT421(A) **CREDITS: 4**

Instruction: 4 Periods & 1 Tut. /Week Sessional Marks: 40

End- Exam: 3 Hours End Exam Marks: 60

COURSE OBJECTIVE:

The course would aim to make the student understand the basic idea of problem solving through the principles of soft computing, which would be seen as a well-balanced integration of fuzzy logic, evolutionary computing, and neural information processing.

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To familiarize with genetic algorithms.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.

To provide the mathematical background for carrying out the optimization associated with neural network learning.

COURSE OUTCOMES:

Upon completion of the course, students should:

CO1 Identify and describe soft computing techniques and their roles in building intelligent systems.

CO2 Recognize the feasibility of applying a soft computing methodology for a particular problem.

CO3 Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.

CO4 Apply genetic algorithms to combinatorial optimization problems.

CO5 Apply neural networks to pattern classification and regression problems.

SYLLABUS

UNIT I **(13 Periods)**

Fuzzy Logic:

Fuzzy Set Theory: Basic Definition and Terminology, Set Theoretic Operations, MF Formulation and Parameterization, MF of two dimensions, Fuzzy Union, Intersection and Complement.

UNIT II **(13 Periods)**

Fuzzy Rules and Fuzzy Reasoning: Extension Principles and Fuzzy Relations, Fuzzy IF THEN Rules, Fuzzy Reasoning. Fuzzy Inference System Introduction, Mamdani Fuzzy models, Other Variants, Sugeno Fuzzy Models, Tekamoto Fuzzy Models.

UNIT III **(13 Periods)**

Genetic Algorithms:

Fundamentals of Genetic Algorithms: Basic Concepts Creation, Offspring's Encoding, Fitness functions, Reproduction, Genetic Modeling: Inheritance Operators, Cross over, Inversion and detection, Mutation operator, Bitwise operators.

UNIT IV **(13 Periods)**

Artificial Neural Networks:

Introduction, Architecture, Back Propagation and feed Forward Networks, Offline Learning, Online Learning.

Supervised Learning of Neural Networks: Introduction, Perceptrons, Adaline Back Propagation Multilayer Perceptrons, Back Propagation Learning Rules, Methods of Speeding. Radial Basis Function Networks, Functional Expansion Networks.

UNIT V **(12 Periods)**

Neuro-FuzzyModeling:

Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

Text Books:

1. J.S.R. Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing" PHI/Pearson Education, New Delhi 2004.

Reference Books:

I. T. J. Ross, "Fuzzy Logic with Engineering Applications." TMH, New York, 1997.
II. D. E. Goldberg, *Genetic Algorithms in Search Optimization and Machine Learning*, Addison Wesley, 3rd Ed.
III. B. Kosko, Neural Network and fuzzy systems, Prentice Hall of India, 2006
IV. Kecman, Learning and Soft Computing, Pearson, 1st Ed, 2001.

COGNITIVE COMPUTING

COURSE IT421(B) | **CREDITS: 4**
Instruction: 4 Periods & 1 Tut. /Week | Sessional Marks: 40
End- Exam: 3 Hours | End Exam Marks: 60

Instructor

COURSE OBJECTIVE:

- Use the Innovation Canvas to justify potentially successful products.
- Explain various ways in which to develop a product idea.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

1. Understand applications in Cognitive Computing.
2. Understand Natural language processor role in Cognitive computing .
3. Learn future directions of Cognitive Computing.
4. Evaluate the process of taking a product to market.

SYLLABUS

UNIT I (chapter 1 & 2) **(13 Periods)**

Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition

Design Principles for Cognitive Systems:

Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services

UNIT II (chapter 3 & 5) **(13 Periods)**

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems

Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations

UNIT III (chapter 4 & 6) **(13 Periods)**

Relationship between Big Data and Cognitive Computing : Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data

Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to create value, Impact of open source tools on advanced analytics

UNIT IV(chapter 8 & 10) **(13 Periods)**

The Business Implications of Cognitive Computing : Preparing for change ,advantages of new disruptive models , knowledge meaning to business, difference with a cognitive systems approach , meshing data together differently, using business knowledge to plan for the future , answering business questions in new ways , building business specific solutions , making cognitive computing a reality , cognitive application changing the market

Employability

The process of building a cognitive application:

Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing

UNIT V (chapter 11 & 12) **(12 Periods)**

Building a cognitive health care application: Foundations of cognitive computing for healthcare, constituents in healthcare ecosystem, learning from patterns in healthcare Data, Building on a foundation of big data analytics, cognitive applications across the health care eco system, starting with a cognitive application for healthcare, using cognitive applications to improve health and wellness, using a cognitive application to enhance the electronic medical record Using cognitive application to improve clinical teaching

Employability

Smarter cities-Cognitive Computing in Government: cities operation, characteristics of smart city, rise of open data movement with fuel cognitive cities, internet of everything and smarter cities, understanding the owner ship and value of data, cities are adopting smarter technology today for major functions, smarter approaches to preventative healthcare, building a smarter transportation infrastructure using analytics to close workforce skills gap, creating a cognitive community infrastructure, next phase of cognitive cities

Employability

TEXTBOOK:

I. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles , "Cognitive computing and Big Data Analytics" , Wiley

CLOUD COMPUTING

COURSE IT421(C) **CREDITS: 4**

Instruction: Sessional Marks: 40

End- Exam: 3 Hours End Exam Marks: 60

COURSE OBJECTIVE:

The objective of this course is to provide graduate students of B.Tech Information Technology with the comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications by introducing and researching state of the art in Cloud Computing fundamental issues, technologies, applications and implementations.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1 Understand the evolution of cloud computing paradigm and its architecture

CO2 Explain and characterize different cloud deployment models, service models and technological drivers

CO3 Understand the programming model and application environment including the role of the Operating systems

CO4 Analyze open source support and networking of cloud

CO5 Identify the security issues in cloud computing

SYLLABUS

UNIT I : (Text Book 1) **(15 Periods)**

Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Biocomputing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing, Network Computing

Cloud Computing Fundamentals: Motivation for Cloud Computing: The Need for Cloud Computing. Defining Cloud Computing: NIST Definition of Cloud Computing, Cloud Computing Is a Service, Cloud Computing Is a Platform 5-4-3 Principles of Cloud computing: Five Essential Characteristics, Four Cloud Deployment Models, Three Service Offering Models Cloud Ecosystem, Requirements for Cloud Services, Cloud Application, Benefits and Drawbacks **Cloud Computing Architecture and Management :** Cloud Architecture, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Migrating Application to Cloud

Emp

UNIT II : (Text Book 1) **(13 Periods)**

Cloud Deployment Models : Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud **Cloud Service Models :** Infrastructure as a Service, Platform as a Service, Software as a Service, Other Cloud Service Models **Technological Drivers for Cloud Computing:** SOA and Cloud: SOA and SOC, Benefits of SOA, Technologies Used by SOA, Similarities and Differences between SOA and Cloud Computing. **Virtualization**: Approaches in Virtualization, Hypervisor and Its Role, Types of Virtualization Multi-core Technology, Memory and Storage Technologies, Networking Technologies Web 2.0, Web 3.0

Em

UNIT III : (Text Book 1) **(12 Periods)**

Programming Models in Cloud : BSP Model, MapReduce Model, SAGA, Transformer, Grid Batch Framework **Operating Systems :** Role of OS in Cloud Computing, Features of Cloud OS, Cloud OS Requirements, Cloud-Based OS Application Environment **Application Environment :** Need for Effective ADE, Application Development Methodologies, Power of Cloud Computing in Application Development Cloud Application Development Platforms: Windows Azure, Google App Engine, Force.com, Manjrasoft Aneka **Cloud Computing APIs:** Rackspace, IBM, Intel **Software Development in Cloud :** Introduction, Different perspectives on SaaS development, New challenges, Cloud aware software development using PaaS technology

Employability

UNIT IV: (Text Book 1) **(10 Periods)**

Networking for Cloud Computing : Introduction, Overview of Data Center Environment, Networking Issues in Data Centers **Cloud Service Providers :** Introduction, EMC, Google, Amazon Web Services, Microsoft, IBM, Salesforce, Rackspace

Employability

Open Source Support for Cloud

Introduction, Open Source in Cloud Computing: An Overview, Difference between Open Source and Closed Source, Advantages of Having an Open Source

Open Source Tools for IaaS: Eucalyptus, Openstack

Open Source Tools for PaaS: Red Hat OpenShift Origin

Open Source Tools for SaaS: Google Drive, Dropbox

Open Source Tools for Research: CloudSim

Employability

UNIT V: (Text Book 1) **(10 Periods)**

Security Aspects Data Security, Virtualization Security, Network Security Platform-Related Security, Security Issues in Cloud Service Models, Software-as-a-Service Security Issues, Platform-as-a-Service Security Issues, Infrastructure-as-a-Service Security Issues

Advanced Concepts in Cloud Computing Intercloud, Cloud Management, Mobile Cloud, Media Cloud, Interoperability and Standards, Cloud Governance, Computational Intelligence in Cloud, Green Cloud, Cloud Analytics

Text Books:

1. K. Chandrasekaran, Essentials of Cloud Computing, CRC Press, 2015

Reference Books:

II. Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2010

III. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 2011

IV. Nikos Antonopoulos, Lee Gillam, Cloud Computing: Principles, Systems and Applications, Springer, 2012

E-COMMERCE

COURSE IT421 (D) — **CREDITS: 4**

Instruction: 4 Periods & 1 Tut /week — Sessional Marks: 40M

End Exam: 3 Hours — End Exam Marks: 60M

Course Objectives:

To provide knowledge about the protocols, methods, security issues in electronic commerce as well as about enterprise resource planning tools, models and techniques.

Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO1 Illustrate the fundamental concepts of Electronic commerce environment and modes

CO2 Select the approaches and authenticative methods for safe E-Commerce

CO3 Develop secure E-mail technologies for E-Commerce

CO4 Evaluate the key aspects of Internet Resources for Commerce, internet Access

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	O10	PO11	PO12	PSO1	PSO2
CO-1	2	3	2	2	2	2	3	-	2	-	3	3	2	3
CO-2	2	2	2	2	2	2	3	-	1	-	3	3	2	3
CO-3	1	1	3	2	2	2	3	-	2	-	2	3	2	3
CO-4	2	3	3	2	2	3	3	-	2	-	3	3	2	3

SYLLABUS

UNIT-I: **PERIODS-14**

Electronic commerce environment and opportunities: Back ground – The Electronic commerce Environment – Electronic Market Place Technologies.
Modes of electronic commerce: Overview – EDI – Migration to open EDI – E commerce with WWW/Internet – Commerce Net Advocacy – Web commerce going forward.

UNIT-II: **PERIODS-12**

Approaches to safe electronic Commerce – Overview – Source – Transport Protocols – Secure Transactions – Secure Electronic Payment Protocol – Secure Electronic Transaction – Certificates for Authentication – Security on Web Servers and enterprise networks.

UNIT-III: **PERIODS-14**

Electronic cash and electronic payment schemes – Internet Monitory Payment and Security requirements – payment and purchase order process – online electronic cash.
Master card/ Visa Secure electronic transaction: Introduction – Business requirements - Concepts - Payment Processing.

UNIT-IV: **PERIODS-12**

Employability

Email and Secure Email Technologies for Electronic Commerce: Introduction – The means of Distribution – A model for Message Handling – How Does a Email Work.

UNIT-V: **PERIODS-12**

Internet Resources for Commerce: Introduction – Technologies for Web Servers – Internet Applications for commerce – Internet Charges – Internet Access and Architecture – Searching the Internet.

Text Books:

I. Web Commerce Technology Hand Book Daniel Minoli, Emma Minoli McGraw Hill, First Edition.

Reference Books:

I. Frontiers of Electronic Commerce Ravi Kalakotar, Andrew B.Whinston, Pearson Education.

IMAGE PROCESSING

COURSE IT422 (A) | **CREDITS: 4**
Instruction: 4 Periods & 1 Tut /week | Sessional Marks: 40M
End Exam: 3 Hours | End Exam Marks: 60M

Course Objectives:

- Cover the basic theory and algorithms that are widely used in digital image processing.
- Expose students to current technologies and issues that are specific to image processing systems.
- Hands-on experience in using computers to process images.
- Formulate solutions to general image processing problems
- Familiar with image manipulations and analysis

Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO1 Explain Basic Concepts in Image Processing and various color models

CO2 Apply Spatial Domain Techniques for Image Enhancement

CO3 List the Image Compression Techniques

CO4 Discuss Various Morphological Algorithms

CO5 Classify Various Image Segmentation Techniques

SYLLABUS

UNIT I: **(13 Periods)**

Digital Image Fundamentals: Digital Image Processing - Examples of fields that Use Image Processing, Fundamental Steps & Components in Digital Image Processing; Image Sampling and Quantization- Basic Concepts of Digital Images, Spatial and Gray level Resolution - Zooming and Shrinking; Basic Relationship Between Pixels.

Color Image Processing: Fundamentals, Color Models – RGB, CMYK, HIS and Pseudo Color.

UNIT II: **(13 Periods)**

Image Enhancement: Basic Gray level Transformations. Histogram processing, Arithmetic/Logical Operations- Image Subtraction and Image Averaging, Basics of Spatial Filtering. Smoothening Spatial Filters, Sharpening Spatial Filters.

employability

UNIT III: **(13 Periods)**

Image Compression: Redundancy- Coding, Inter Pixel, Psycho-Visual, Fidelity Criteria; Image Compression Models-The Source Encoder and Decoder, The Channel Encoder and Decoder; Error- Free compression-Variable Length Coding, LZW Coding, Bit-Plane Coding, Image Compression Standard – JPEG

UNIT IV: **(13 Periods)**

Image Morphology: Preliminaries- Basic Concepts from Set Theory, Logical Operations Involving Binary Images, Dilation and erosion, opening and closing, The Hit or Miss Transformation, Basic Morphological algorithms-Boundary Extraction, Region Filling Extraction of Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning.

employability

UNIT V: **(12 Periods)**

Image Segmentation: Detection of discontinuities-point detection, line detection, edge detection, edge linking and boundary detection-local processing, global processing via Graph-Theoretic techniques, Thresholding-Basic Global Thresholding, Basic Adaptive Thresholding, Optimal Global and Adaptive Thresholding, Region- Based Segmentation-Basic Formulation, Region growing, Region Splitting and Merging.

employability

Text Books:

1. Digital Image Processing – R.C. Gonzalez & R.E. Woods, Addison Wesley / Pearson Education, 3rd Edition, 2010.

Reference Books:

I. Fundamentals of Digital Image Processing-A.K. Jain, PHI.

CYBER SECURITY

COURSE IT422 (B) **CREDITS: 4**
Instruction: 4 Periods & 1 Tut /week Sessional Marks: 40M
End Exam: 3 Hours End Exam Marks: 60M

PREREQUISITE: Fundamentals of computers, knowledge in any program language.

COURSE OUTCOMES:
Understand the concepts and terminology of high performance computing

CO 1 Understand cyber crimes and types of cyber attacks

CO 2 Know how to prevent themselves from cyber attacks

CO 3 Identify applicable cyber laws

SYLLABUS

UNIT I: **(8 Periods)**

Introduction to Cyber crime: definition and origins of the world, Cyber crime and information security, Classifications of cyber crime, Cyber crime and the Indian ITA 2000, A global Perspective on cyber crimes,

Cyber offenses: Planning the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cyber crimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

Em

UNIT II: **(10 Periods)**

Cyber crime using Mobile and Wireless Devices: Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in, Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices,, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on, Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era

En

UNIT III: **(10 Periods)**

Tools and Methods Used in Cybercrime: Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks

E

UNIT IV: **(10 Periods)**

Forensics of Handheld Devices

Understanding Cell Phone Working Characteristics, Handheld Devices and Digital Forensics, Toolkits for Hand-Held Device Forensics, Forensics of iPods and Digital Music Devices

Digital Forensics Case Illustrations, Real Life Use of Forensics, Case-studies on Financial Frauds in Cyber Domain, Digital Signature-Related Crime Scenarios

Empl

UNIT V: **(10 Periods)**

Cyber crimes and Cyber security: The Legal Perspectives: Cyber crime and the Legal Landscape around the World, Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber crime Scenario in India, Consequences of, Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cyber crime and Punishment, Cyber law, Technology and Students: Indian Scenario

Text Books:

1. Nina Godbole & Sunit Belapure "Cyber Security", Wiley India, 2012.

Reference Books:

II. Harish Chander, "cyber laws & IT protection", PHI learning pvt.ltd, 2012.
III. Dhiren R Patel, "Information security theory & practice",PHI learning pvt ltd,2010.
IV. MS.M.K.Geetha & Ms.Swapne Raman"Cyber Crimes and Fraud Management, "MACMILLAN, 2012.
V. Pankaj Agarwal : Information Security & Cyber Laws (Acme Learning), Excel, 2013.
VI. Vivek Sood, Cyber Law Simplified, TMH, 2012.

ENTERPRISE RESOURCE PLANNING

COURSE IT422 (C) **CREDITS: 4**
Instruction: 4 Periods & 1 Tut /week Sessional Marks: 40M
End Exam: 3 Hours End Exam Marks: 60M

PREREQUISITE: Fundamentals of computers, knowledge in any program language.

COURSE OUTCOMES:
After completion of this course, a student will be able to:
CO 1 Select the fundamental concepts of ERP systems their architecture, and working of different modules in ERP.

CO 2 Decide how to implement activities of ERP project management cycle
CO 3 Identify the emerging trends in ERP developments.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**			1		1		1		1	**3**	1	1	**2**
CO2	**3**	**3**	**1**	3	1	1		1		1	**3**	1	1	**3**
CO3	**3**	**3**				1		1		1	**3**	1	1	**3**

SYLLABUS

UNIT I: **(8 Periods)**

Introduction: Overview of enterprise systems – Evolution - Risks and benefits - Fundamental technology - Issues to be consider in planning design and implementation of cross functional integrated ERP systems.

UNIT II: **(10 Periods)**

ERP SOLUTIONS AND FUNCTIONAL MODULES: Overview of ERP software solutions- Small, medium and large enterprise vendor solutions, BPR, and best business practices - Business process Management, Functional modules.

UNIT III: **(10 Periods)**

ERP IMPLEMENTATION: Planning Evaluation and selection of ERP systems - Implementation life cycle - ERP implementation, Methodology and Framework- Training – Data Migration. People Organization in implementation Consultants, Vendors and Employees.

UNIT IV: **(10 Periods)**

POST IMPLEMENTATION: Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation.

UNIT V: **(10 Periods)**

EMERGING TRENDS ON ERP: Extended ERP systems and ERP add-ons -CRM & SCM, Business analytics - Future trends in ERP systems-web enabled, Wireless technologies, cloud computing.

Text Books:

1. Alexis Leon, ERP demystified, second Edition Tata McGraw-Hill, 2008.

Reference Books:

I. Sinha P. Magal and Jeffery Word, Essentials of Business Process and Information System, Wiley India, 2012
II. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008
III. Alexis Leon, Enterprise Resource Planning, second edition, Tata McGraw-Hill, 2008.
IV. Mahadeo Jaiswal and Ganesh Vanapalli, ERP Macmillan India, 2009
V. Vinod Kumar Grag and N.K. Venkitakrishnan, ERP- Concepts and Practice, Prentice Hall of India, 2006.
VI. Summer, ERP, Pearson Education, 2008

INTERNET OF THINGS

COURSE IT422 (D) **CREDITS: 4**

Instruction: 4 Periods & 1 Tut /week Sessional Marks: 40M

End Exam: 3 Hours End Exam Marks: 60M

PREREQUISITE: Fundamentals of computers, C programming, Computer Networks and microcontrollers.

COURSE OUTCOMES:

After completion of this course, a student will be able to:

CO 1 Understand the concepts of Internet of Things

CO 2 Know basic communication protocols in IoT

CO 3 Design IoT applications in different domains and Implement basic IoT applications on embedded platforms

CO4 Learn real world application scenarios of IoT along with its societal and economic impact using case studies.

SYLLABUS

UNIT I: (TextBook 1) 8 Periods

Introduction: Internet of Things Vision, Emerging Trends, Economic Significance, Technical Building Blocks, Physical design of IoT, Things of IoT, IoT Protocols, Logical design of IoT, IoT functional blocks, IoT communication models, IoT Communication APIs, IoT enabling technologies, IoT levels and deployment templates, IoT Issues and Challenges, Applications.

UNIT II: (TextBook 3) 10 Periods

Communication Protocols: Protocol Standardization for IoT, Efforts, M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization, Unified Data Standards, Protocols – IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, Network layer, APS layer.

UNIT III: (TextBook 1) 10 Periods

IoT Physical Devices and Endpoints: Basic building blocks of and IoT device, Exemplary device: Raspberry Pi, Raspberry Pi interfaces, Programming Arduino with sensor interfaces.

employability

UNIT IV: (TextBook 2) 10 Periods

Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud Standards – Cloud Providers and Systems, Mobile Cloud Computing, The Cloud of Things Architecture, Cloud Storage Models, Communication API and Xively Cloud for IoT (TextBook 1)

employability

UNIT V: (TextBook 1) 10 Periods

Web Application Framework: Amazon Web Services for IoT
IoT Application Case Studies: Home Intrusion Detection, Weather Monitoring System, Air Pollution Monitoring, Smart Irrigation.

employability

Text books

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515
2. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012. ISBN : 9781439892992
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer, 2011. ISBN: 978-3-642-19156-5

Reference Books:

I. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010, ISBN:10: 0521195330

II. Olivier Hersent, Omar Elloumi and David Boswarthick, “The Internet of Things: Applications to the Smart Grid and Building Automation”, Wiley, 2012, 9781119958345

III. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012, ISBN:978-1-119-99435-0

IV. Barrie Sosinsky, “Cloud Computing Bible”, Wiley-India, 2010.ISBN : 978-0-470-90356-8

V. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, Wiley, 2014, ISBN: 978- 1-118-43063-7

VI. Christopher Hallinan, “Embedded Linux Primer”, Prentice Hall, ISBN:13: 978-0-13-167984-9

NETWORK ANALYSIS AND SYNTHESIS	
ECE 124	**Credits:3**
Instruction: 3 Periods & 1 E/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To understand the basic laws and elements of electrical engineering.
- To analyze the electrical planar and non planar networks .
- To understand the concept of magnetic circuit.

Course Outcomes:

By the end of the course student should be able to:	
1	Identify the parameters of the two port networks and coupled circuits.
2	Analyze the effect of resonance and study of 3 phase circuits.
3	Measure and analyze the transients in DC circuits.
4	Write the Laplace transform equations and apply them to single port and two port networks.
5	Realize a physical network for a given immittance function.

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	-	-												
	2	3	-	-												
	3	3	-	-												
	4	3	-	-												
	5	3	-	-												

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

SYLLABUS

SKILL DEVELOPMENT

UNIT-I: **(10 periods)**

Coupled Circuits: Magnetically coupled circuits, dot convention.

Two-port Networks: Z, Y, H, T Parameters of two port networks.

UNIT-II: **(10 periods)**

Resonance: Series and parallel resonant circuits, bandwidth and Q-factor.

Three phase circuits: 3 phase balanced circuits.

SKILL DEVELOPMENT

UNIT-III: **(10 periods)**

DC Transients: Source free RL & RC circuits, Driven RL & RC circuits, Natural and forced response of RL & RC circuits. Source free and driven RLC circuits, Natural and forced response of RLC circuits.

SKILL DEVELOPMENT

UNIT-IV: **(10 periods)**

Laplace Transform:

Introduction to Laplace transform, Initial and final value theorems, Application of Laplace transforms to electrical circuits.

SKILL DEVELOPMENT

Network function:

Network function for single port and two port networks, poles and zeros, scaling of network functions, Positive real functions and their properties.

UNIT-V: **(8 periods)**

Network Synthesis: Elementary Synthesis Operation, LC Network Synthesis, Properties of RC Network Functions, Foster and Cauer Forms of RC and RL Networks.

SKILL DEVELOPMENT

Text books:

1. W. H. Hayt Jr & J. E. Kemmerly, Engineering circuit analysis, 7th edition, Mc Graw Hill publications 2006.
2. M. E. Van Valkenburg, Network analysis, 3rd edition, prentice Hall of India 1974.
3. M.E. Van Valkenburg,Modern network synthesis,Wiley Eastern limited.

Reference books:

1. C. K. Alexander & M. N. O. Sadiku, Fundamentals of Electric Circuits, 5th Edition, McGraw-Hill publishers.
2. Gopal.G. Bhise, Engineering Network Analysis & Filter Design, Umesh Publications.

ENGINEERING MATHEMATICS –III	
ECE 211	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student should be able to:	
1.	Understanding the concepts of Gradient, Divergence and Curl and finding scalar potential function of irrrotational vector fields.
2.	Understanding the concepts of Green's Theorem, Stokes' Theorem and the Divergence Theorem and to evaluate line integrals, surface, integrals and flux integrals.
3.	Understand some basic techniques for solving linear partial differential equations and how to identify a partial differential equation in order to determine which technique(s) can best be applied to solve it.
4.	Understand the methods to solve the Laplace, heat, and wave equations.
5.	Gain good knowledge in the application of Fourier Transforms.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	-	-	-	-	-	-	-	-	-	2	2	-	3
	2	3	1	-	-	-	-	-	-	-	-	-	2	2	-	3
	3	3	1	-	-	-	-	-	-	-	-	-	2	2	-	3
	4	3	2	-	-	-	-	-	-	-	-	-	2	2	-	3
	5	3	2	-	-	-	-	-	-	-	-	-	2	2	-	3

SYLLABUS

UNIT-I VECTOR DIFFERENTIATION **12 Periods**

Differentiation of Vectors – Scalar and Vector point function – Del applied to Scalar point functions - Gradient geometrical interpretations – Directional Derivative - Del applied to vector point function – divergence - Curl – Physical interpretation of Divergence and Curl - Del applied twice to point functions- Del applied to product of point functions.

UNIT-II VECTOR INTEGRATION **12 Periods**

Integration of vectors – Line integral – Surface – Green's theorem in the plane – Stokes theorem – Volume integral – Gauss Divergence theorems (all theorems without proofs) – Irrotational fields .

UNIT-III PARTIAL DIFFERENTIAL EQUATIONS 12 Periods

Introduction – Formation of Partial Differential Equations – Solution of Partial Differential Equations by Direct Integration – Linear Equations of the First order – Higher order Linear Equations with Constant Co-efficients – Rules for finding the complementary function - Rules for finding the Particular integral – Non- Homogeneous linear equations with constant coefficients.

UNIT –IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12 Periods

Introduction – Method of separation of variables – Vibrations of a stretched string- Wave equation – One dimensional Heat flow - Two dimensional Heat flow – Solution of Laplace's equation.- Laplace's equation in Polar Co-ordinates.

UNIT-V FOURIER TRANSFORMS 12 Periods

Introduction – definition – Fourier integral theorem - Fourier sine and cosine integrals – Complex form of Fourier integrals – Fourier integral representation of a function – Fourier Transforms – Properties of Fourier Transforms – Convolution Theorem – Parseval's identity for Fourier transforms – Fourier Transforms of the Derivatives of functions – Application of Transforms to Boundary value problems – Heat conduction – Vibrations of a string.

Text Books:

1. Dr. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, New Dehli, 2014.

Reference books:

1. A Text book on Engineering Mathematics by N.P. Bali Etal, Laxmi pub.(p)Ltd , 2001.
2. Advanced Engineering Mathematics by H.K.Dass , S.Chand Publications, 2007.
3. Advanced Engineering Mathematics by Erwin kreyszig, John Wiley Publications, 1999.

ELECTRICAL MACHINES	
ECE 212	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student should be able to:	
1.	Find efficiency of DC Machine
2.	Find Regulation and Efficiency of Single phase Transformer
3.	Analyze the performance of Induction Motors
4.	Understand working of synchronous machine
5.	Understand basic concepts of Electric Power System

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2			-	-	-	-	-	-	-	-	-	-	-	2
	2	2			-	-	-	-	-	-	-	-	-	-	-	2
	3	2	2		-	-	-	-	-	-	-	-	-	-	-	2
	4	1			-	-	-	-	-	-	-	-	-	-	-	2
	5	1			-	-	-	-	-	-	-	-	-	-	-	2

SYLLABUS

UNIT-I

DC Machines **18 Periods**

Constructional Features, Function of Commutator, Induced EMF and Torque Expressions, Relationship Between Terminal Voltage and Induced EMF for Generator and Motoring Action, Different Types of Excitation and Performance Characteristics of Different Types of DC Machines, Starting and Speed Control of DC Motors, Losses and Efficiency, Efficiency by Direct Loading, Swinburne's Test, and Applications of DC Machines.

SKILL DEVELOPMENT

UNIT -II **12 Periods**

Transformers

Constructional Details, EMF Equation, Equivalent Circuit, Voltage Regulation, Losses and Efficiency, Auto – Transformers, Open/Short – Circuit Tests and Determination of Efficiency and Regulation.

SKILL DEVELOPMENT

UNIT-III **16 Periods**

Induction Motors

Three-phase Induction Motors Rotating Magnetic Field, Construction of 3-ph Induction Motor, Power Flow Diagram, Torque and Torque-slip Characteristics, Condition for Max.

SKILL DEVELOPMENT

Torque and its Value, Starting methods of 3-phase Induction Motor, Losses and Efficiency, Efficiency and Torque – Speed Characteristics.

Single-phase Induction Motors: Double Revolving Field Theory, Methods of Starting Single Phase Induction Motors, Stepper Motor.

SKILL DEVELOPMENT

UNIT-IV **10 Periods**

Three – Phase Synchronous Machines

Generation of EMF, Constructional Details, Induced EMF, Synchronous Generator on No – Load and Load, Synchronous Impedance and Voltage Regulation, Starting of Synchronous Motors, Applications of Synchronous Machines.

SKILL DEVELOPMENT

UNIT-V **8 Periods**

Electric Energy System (Elementary treatment only)

Single Line Diagram of AC Power supply systems, Types of Power Generation sources(Conventional and Non – Conventional),Power Distribution Systems(Radial and Ring Main Systems).

Text books:

1. J.B. Gupta, "Theory and Performance of Electrical Machines" , S. K. Kataria& Sons, 2009
2. P.S Bimbra, "Electrical Machinery", Khanna Publications, 7th Edition, 2009
3. V.K.Mehta, Rohit Mehta, "Principles of Power System", S. Chand Publications, 4th Edition, 2008

References:

1. Electrical Machines, S. K. Bhattacharya, TMH Publications N. Delhi.

DATA STRUCTURES	
ECE 213	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student should be able to:	
1	Demonstrate the knowledge in problem solving techniques.
2	Write programs for different data structures
3	Implement different applications using tree structures.
4	Implement various sorting techniques
5	Apply and implement learned algorithm design techniques and data structures to solve problems using Graphs.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	1									2	-	-	2
	2	2	1	-									2	-	-	2
	3	1	-	1									2	-	-	2
	4	1	-	1									2	-	-	2
	5	2	2	1									2	-	-	2

SYLLABUS

UNIT I

ARRAYS AND STACKS **12-Periods**

Introduction: Basic Terminology, Elementary Data Organization, Data Structure operations, Algorithm Complexity and Time-Space trade-off.

Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Sparse Matrices.

Stacks: Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of Postfix & Prefix expressions using stack, Recursion, Towers Of Hanoi Problem.

UNIT II

QUEUES AND LINKED LIST **12 –Periods**

Queues: Array representation and implementation of queues, Operations on Queue: Insert, Delete, Full and Empty. Circular queue, De-queue, and Priority Queue, Applications of Queues.

Linked list: Representation and Implementation of Singly Linked Lists, Traversing and Searching of Linked List, Insertion and deletion to/from Linked Lists, Doubly linked list, Circular Doubly linked list, Implementing priority queue using Linked List, Polynomial Representation using Linked list & addition.

UNIT III

TREES AND SEARCHING **12-Periods**

Trees: Basic terminology, Binary Trees, Binary tree representation, Almost Complete Binary Tree, Complete Binary Tree, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees.

Searching: Sequential search, binary search, Interpolation Search, comparison and analysis, Hash Table, Hash Functions.

UNIT IV

BINARY SEARCH TREES AND BASIC SORTING TECHNIQUES **12-Periods**

Sorting: Insertion Sort, Bubble Sort, Selection sort, Merge Sort.

Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, AVL Trees.

UNIT V

GRAPHS **10-Periods**

Graphs: Terminology & Representations- Graphs, Directed Graphs, Adjacency Matrices, Path OR Transitive Closure of a Graph, Warshall's Algorithm, Shortest path Algorithm-Dijkstra's Algorithm, Connected Component and Spanning Trees, Minimum Cost Spanning Trees,Graph Traversals.

Text Books

1. Y. Langsam, M. Augenstin and A. Tannenbaum, "Data Structures using C and C++", Pearson Education, 2nd Edition, 1995.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education.

References:

1. E.Horowitz and Sahani, "Fundamentals of Data Structures"
2. C Programming and Data structures, P. Padmanabham, 3rd Edition, BS publications..
3. S. Lipschutz, "Data Structures", McGraw Hill, 1986.
4. Programming in C , P. Dey & M. Ghosh, Oxford Univ. Press.
5. ISRD Group, "Data Structures through C++", McGraw Hill, 2011.

SIGNALS AND SYSTEMS	
ECE 214	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student should be able to:	
1	Apply transformations on the independent variable of the given CT and DT signals and analyze the properties of CT and DT signals and systems.
2	Represent mathematically the CT and DT LTI systems and determine the response of an LTI system for the given input signal using either convolution integral or convolution sum.
3	Represent CT and DT signals and systems in the Frequency domain using Fourier Analysis tools like CTFS, CTFT, DTFS and DTFT.
4	Represent the CT signals in terms of its samples and reconstruct using interpolation.
5	Represent DT signals in the Frequency domain and analyze DT systems using Z-Transforms and analyze CT signal and systems using Laplace transforms

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1	-	-	-	-	-	-	-	-	-	-	2	2	-
	2	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
	3	2	1	-	-	-	-	-	-	-	-	-	-	3	2	-
	4	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
	5	2	1	-	-	-	-	-	-	-	-	-	-	2	2	-

SYLLABUS

Unit- I Introduction to Signals and Systems 10 Periods

Continuous-Time (CT) signals and Discrete-Time (DT) signals and their representation, commonly used CT and DT signals: impulse, step, pulse, ramp and exponentials, classification of CT and DT signals: periodic and aperiodic, even and odd, energy signals and power signals, operations on CT and DT signals- addition, subtraction, multiplication, differentiation and integration of CT signals, convolution and correlation of two signals (CT& DT), properties of convolution operation. Time-shifting and time-scaling of CT and DT signals, classification of CT and DT systems: static and dynamic, linear and non-linear,time- invariant and time-varying, basic concepts like causality,stability and invertability of systems.

Unit-II Linear Time-Invariant Systems 10 Periods

CT and DT type of LTI systems, impulse response function and unit-sample response sequence, Input-Output relation through convolution summation/ integral, characterization of CT and DT types of LTI systems, impulse response function/ sequence and causalitity of LTI systems, interconnectected LTI systems (CT and DT), CT type of LTI systems described by Linear constant coefficient differential equations, DT type LTI systems described by constant coefficient linear difference equations, BIBO stability of LTI systems (CT and DT types).

EMPLOYABILITY

Unit III Analysis of CT Signals and Systems 12 Periods

Fourier series analysis of CT Signals, CT Fourier transform(FT) and its inverse; magnitude and phase spectra, FT using impulses, FT as a particular case of Laplace Transform(LT), FT and LT in CT system analysis, magnitude and phase responses of CT type LTI systems, block diagram representation of Linear Differential Equations with constant coefficients, pole-zero locations, causality (Paley- Wiener Criterion)and stability, distortionless transmission of signals through CT type LTI systems.

EMPLOYABILITY

Unit IV Analysis of DT Signals and Systems 15 periods

Discrete –time Fourier transform(DTFT) & inverse DTFT; convergence of DTFT and IDTFT; DTFT properties and theorems, discrete Fourier transform (DFT)& inverse DFT; properties and theorems, circular convolution, Z-Transform(ZT) & its properties & theorems, inverse ZT, inversion methods power series, PFE and Residue methods, solution of difference equations using ZT, distortionless transmition through DT type of LTI systems, ROCs of right-sided, left sided and finite duration sequences, relationship between ZT, DTFT and DFT.

Application of ZT, DTFT and DFT in DT signal and system analysis, DT system function, transfer function, poles and zeros, stability, block diagram representation of difference equations, processing of CT signals using DFT.

Unit V Sampling of Lowpass and Bandpass Signals 10 periods

Lowpass sampling theorem and its proof, types of sampling: impulse sampling, natural sampling and flat-top sampling, spectra of sampled vertions, aliasing, Nyquist rate, anti-aliasing filter, reconstruction of band – limited lowpass signal from its samples, aperture effect due to flat- top sampling, reconstruction filters and zero – order hold(ZOH), sampling of bandpass signals and bandpass sampling theorem.

Text Books :

1. A.V. Oppenheim, AS Willsky and S.H. Nawab: Signals and Systems, Pearson.
2. S.Haykin and B.V Veen: Signals and Systems, John Wiley

References:

1. P. Ramakrishna Rao and Shankar Prakriya : Signals and Systems, second addition, McGraw Hill (India) pvt Ltd. 2013
2. Nagoor Kani: Signals and Systems, McGraw Hill
3. E.W Kamen and B.S.Heck: Fundamentals of Signals and Systems using the Web and Matlab, Pearson.
4. P. Ramesh Babu and R. Anandanatarajan: Signals and Systems 4/e, Scitech.
5. K. Raja Rajeswari and B. Visveswara Rao: Signals and Systems , PHI.

NETWORK ANALYSIS AND SYNTHESIS	
ECE 215	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student should be able to:	
1	Apply basic network theorems and analyze both D.C and A.C. circuits.
2	Determine various parameters of two port networks.
3	Analyze circuits under resonant condition.
4	Calculate natural and forced response of RL, RC & RLC circuits
5	Measure real, reactive, apparent power in three phase circuits.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	1	1										3	1	-
	2	3	1	2										1	1	-
	3	2	2	2										3	2	2
	4	3	1	2										1	-	1
	5	2	2	3										2	1	2

SYLLABUS

UNIT-I

ANALYSIS OF DC CIRCUITS SKILL DEVELOPMENT **10 periods**

Active Element, Passive Element, Reference Directions For Current and Voltage, Kirchoff's Laws, Voltage and Current Division, Nodal Analysis, Mesh Analysis, Linearity and Superposition, Thevenin's and Norton's Theorems, Source Transformation.

UNIT-II SKILL DEVELOPMENT

DC TRANSIENTS **12 periods**

Inductor, Capacitor, Source Free RL, RC & RLC Response, Evaluation of initial Conditions, Application of Unit-Step Function to RL, RC & RLC Circuits, Concepts of Natural, Forced and Complete Response.

SKILL DEVELOPMENT

UNIT-III

SINUSOIDAL STEADY-STATE ANALYSIS **14 periods**

The Sinusoidal Forcing Function, Phasor, Instantaneous and Average Power, Complex Power, Steady State Analysis Using Mesh and Nodal Analysis, Application of Network Theorems to A.C. Circuits.

UNIT-IV

RESONANCE &COUPLEDCIRCUITS **12periods**

Balanced Three Phase Circuits, Resonance, Concept of Duality. Coupled Circuits: Magnetically Coupled Circuits, Dot Convention.

SKILL DEVELOPMENT

UNIT-V

NETWORK SYNTHESIS **10 periods**

Elementary synthesis operation, LC network synthesis, Properties of RC network functions, Foster and Cauer forms of RC and RL networks.

SKILL DEVELOPMENT

Text books:

1. W.H. HAYT Jr & J.E. KEMMERLY, "ENGINEERING CIRCUIT ANALYSIS, 5th Edition, Mc. Graw Hill Pub.
2. M.E. VAN VALEKNBURG, "NETWORK ANALYSIS", 3rd Edition, PHI Learning.

Reference book:

1. Circuits and Networks by A. Sudhakar Shyammohan S Palli, 4^{th} Edition, TMH Publication.

ELECTRONIC CIRCUITS AND ANALYSIS-I LABORATORY	
ECE 217	**Credits:2**
Instruction: 3 Practical's / Week	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Course Outcomes:

By the end of the course student should be able to:	
1	Measure the important parameters of a PN diode and to implement for various Applications.
2	Design and construct different rectifier and voltage regulation circuits used in regulated Power supplies.
3	Design amplifier circuits for specific applications, based on their input and output Characteristics of BJT and FET.
4	Design and verify the output of linear wave shaping circuits for different inputs.
5	Design and analyze different multivibrator circuits.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	-	1	3	2	-	-	-	-	-	-	-	2	2	1
	2	2	-	2	3	2	-	-	-	-	-	-	-	2	2	1
	3	2	-	2	3	2	-	-	-	-	-	-	-	2	2	1
	4	2	-	2	3	2	-	-	-	-	-	-	-	2	2	1
	5	2	-	2	3	2	-	-	-	-	-	-	-	2	2	1

LIST OF EXPERIMENTS

Cycle-I Design and simulation using MultiSim software

1. Plot the V-I characteristics of a PN diode in forward and reverse bias and find the static, dynamic resistances and the reverse saturation current.
2. Plot the V-I characteristics and regulation characteristics of a Zener diode in reverse bias.
3. Plot the output waveforms of a halfwave rectifier and find the ripple factor.
4. Plot the output waveforms of a fullwave rectifier using 2 diodes.
5. Plot the output waveforms of a Bridge rectifier and find the ripple factor.
6. Low pass and High pass circuits
7. Clippers and Clampers circuit
8. Plot the input and output characteristics of CE configured transistor and to find the h-parameter values from the characteristics.
9. Plot the input and output characteristics of CB configured transistor and to find the h-parameter values from the characteristics.
10. Plot the input and output characteristics of CC configured transistor and to find the h-parameter values from the characteristics.
11. Plot the drain and transfer characteristics of a JFET.
12. Plot the frequency response of a single stage CE amplifier.

SKILL DEVELOPMENT

13. Plot the frequency response of a single stage CC amplifier.
14. Verify the working of a BJT as a switch.
15. Frequency Response of a RC coupled multistage amplifier
16. Study the operation of a Bistable multivibrator and observe the switching action.
17. Astable Multivibrator
18. Monostable Multivibrator
19. Observe the hysteresis loop of a Schmitt trigger circuit
20. Design and implement a DC regulated power supply.

Cycle-II (Hardware experiments)

1. Plot the V-I characteristics of a PN diode in forward and reverse bias and find the static, dynamic resistances and the reverse saturation current.
2. Plot the V-I characteristics and regulation characteristics of a Zener diode in reverse bias.
3. Plot the output waveforms of a halfwave rectifier and find the ripple factor.
4. Plot the output waveforms of a fullwave rectifier using 2 diodes.
5. Plot the output waveforms of a Bridge rectifier and find the ripple factor.
6. Plot the input and output characteristics of CE configured transistor and to find the h-parameter values from the characteristics.
7. Plot the input and output characteristics of CB configured transistor and to find the h-parameter values from the characteristics.
8. Plot the drain and transfer characteristics of a JFET.
9. Verify the working of a BJT as a switch.
10. Plot the frequency response of a single stage CE amplifier.
11. Plot the frequency response of a single stage CC amplifier.
12. Study the operation of a Bistable multivibrator and observe the switching action.
13. Observe the hysteresis loop of a Schmitt trigger circuit

SKILL DEVELOPMENT

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
2. Jacob Millman & Herbert Taub, “Pulse Digital & Switching Waveforms” McGraw-Hill Book Company Inc.

References:

1. Donald A. Neamon, “Electronic Circuit Analysis and Design”, 2nd Edition. TMH publications.

NETWORK & EM LABORATORY	
ECE 218	**Credits:2**
Instruction: 3 Practical's / Week	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Course outcomes:

By the end of the course student should be able to:	
1	Conduct the experiments based on basic network theorems.
2	Predict the characteristics of D.C machines and single phase transformers
3	Predict the regulation of an alternator.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	1	1	3	-	1	-	-	-	-	-	-	3	-	2
	2	3	2	-	3	-	2	-	-	-	-	-	-	2	1	1
	3	2	1	1	3	-	1	-		-	-	-	-	2	1	1

LIST OF EXPERIMENTS

CYCLE-I: Networks Lab

SKILL DEVELOPMENT

1. To obtain filament lamp characteristics.
2. Verification of KCL & KVL.
3. Verification of superposition theorem.
4. Verification of Thevenin's and Norton's theorem.
5. Determination of two port network parameters.

CYCLE-II: Electrical Machines Lab

1. O.C.C & Load characteristics of D.C shunt generator.
2. Swinburne's test on D.C. shunt machine.
3. Brake test on D.C. shunt motor.
4. O.C. & S.C test on a single phase transformer.
5. Brake test on 3-phase induction motor.
6. Regulation of alternator by e.m.f. method.

SKILL DEVELOPMENT

Textbooks:

1. W.H.Haytjr & J.E.Kemmerly , "Engineering Circuit Analysis" , 5th Edition, Mc. Graw Hill Pub.
2. J.B. Gupta, "Theory and Performance of Electrical Machines" ,S. K. Kataria& Sons, 2009

ENGINEERING MATHEMATICS –IV	
ECE 221	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student should be able to:	
1	Understand, interpret and use the basic concepts: Analytic function, harmonic function, Taylor and Laurent Series, Singularity, Residues and evaluation of improper integrals.
2	Familiarize the concepts of Finite Differences and Interpolation techniques.
3	Familiarize the concept of Differentiation and Integration by numerical methods.
4	Understand the characteristics and properties of Z-transforms and its applications.
5	Analyze the Statistical data by using statistical tests and to draw valid inferences about t population parameters.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1	-	-	-	-	-	-	-	-	-	-	2	-	1
	2	2	1	-	-	-	-	-	-	-	-	-	-	2	-	1
	3	2	1	-	-	-	-	-	-	-	-	-	-	2	-	1
	4	2	1	-	-	-	-	-	-	-	-	-	-	2	-	1
	5	2	1	-	-	-	-	-	-	-	-	-	-	2	-	1

SYLLABUS

UNIT-I FUNCTIONS OF A COMPLEX VARIABLE 14 Periods

Introduction –Limit of a Complex function- Derivative of $f(z)$ – Analytic functions-Harmonic functions - Applications to Flow problems. Complex Integration- Cauchy's Theorem- Cauchy's Integral Formula –Series of Complex terms (Statements of Taylor's and Laurent's Series without proof) - Zeros of an Analytic function - Residues - Calculation of Residues - Evaluation of Real Definite Integrals (Integration around the unit circle, Integration around the small semi circle , Indenting the Contours having poles on the real axis).

Geometric representation of $f(z)$, Some standard transformation
($w = z + c, w = cz , w = \frac{1}{z}$, $w = \frac{az+b}{cz+d}$) .

UNIT-II FINITE DIFFERENCES & INTERPOLATION 12 Periods

Finite Differences – Forward differences – Backward differences – Central differences – Differences of a Polynomial – Factorial Notation – Other difference operators – To find one or more missing terms – Newton's Interpolation Formulae – Central Difference Interpolation Formulae - Interpolation with Unequal Intervals – Lagrange's interpolation formula – Inverse Interpolation.

UNIT-III NUMERICAL DIFFERENTIATION AND INTEGRATION 10 Periods

Numerical Differentiation – Formulae for derivatives – Maxima and Minima of a Tabulated Function – Numerical Integration – Newton-Cotes Quadrature Formula – Trapezoidal rule – Simpson's One-Third rule , Simpson's Three-Eighth rule.

UNIT - IV Z – TRANSFORMS 12 Periods

Introduction – Definition - Some Standard Z-Transforms –Linearity Property –Damping Rule – Some Standard Results - Shifting U_n to the right , Shifting U_n to the left – Two basic theorems (Initial Value Theorem and Final Value Theorem) – Convolution Theorem – Convergence of Z-transforms – Two sided Z - transform of U_n - Evaluation of inverse Z- transforms (Power Series Method , Partial Fraction Method , Inverse integral method) - Applications to Difference equations.

UNIT-V SAMPLING THEORY 12 Periods

Introduction – Sampling Distribution – Testing a hypothesis – Level of Significance – Confidence Limits – Test of Significance of Large samples (Test of significance of single mean, difference of means) – Confidence limits for unknown – Small samples – Students t-distribution – Significance test of a sample mean – Significance test of difference between sample means – Chi-Square (χ^2) Test – Goodness of fit.

Text Books:

1. Dr. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, New Dehli, 2014.

Reference books:

1. N.P. Bali Etal, "A Text book on Engineering Mathematics", Laxmi pub.(p) Ltd , 2011.
2. H.K.Dass "Advanced Engineering Mathematics", S.Chand Publications, 2007.
3. Erwin kreyszig, "Advanced Engineering Mathematics", John Wiley Publications, 1999.

ELECTRONIC CIRCUITS AND ANALYSIS-II	
ECE 222	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student should be able to:	
1	Analyze negative feedback amplifiers and sinusoidal oscillators for different performance metrics such as input impedance, output impedance, voltage gain, condition for oscillations, frequency of oscillations etc.
2	Determine the resonant frequency for the tuned voltage amplifiers and analyze class-A, class-B, class-AB , class-C amplifiers for efficiency.
3	Analyze current mirror differential amplifier circuits using BJTs.
4	Design and analyze analog circuits like integrator, differentiator, comparator, instrumentation amplifier and logarithmic amplifier using op-amps.
5	Analyze the response of common source, common drain and common gate amplifiers with enhancement and depletion loads.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	-	-	-	-	-	-	-	-	-	-			1
	2	3	2	-	-	-	-	-	-	-	-	-	-			1
	3	3	2	-	-	-	-	-	-	-	-	-	-			1
	4	3	2	2	-	-	-	-	-	-	-	-	-			2
	5	3	2	-	-	-	-	-	-	-	-	-	-			1

SYLLABUS

Unit-I

Feedback Amplifiers **14 Periods**

Classification of amplifiers, the feedback concept, general characteristics of negative feedback, effect of negative feedback on input and output impedance, Method of analysis of feedback amplifiers,

Oscillators

Sinusoidal oscillators, Phase shift oscillators, Resonant circuit oscillators, General form of oscillator circuit, The wien bridge oscillator, crystal oscillators, Frequency stability.

SKILL DEVELOPMENT

Unit-II

Tuned voltage amplifiers **10 Periods**

Introduction, need for tuned voltage amplifiers, operation of single tuned, double tuned and stagger tuned amplifiers.

Power Amplifiers

Class A Large Signal amplifiers, Second Harmonic Distortion, Higher order Harmonic Distortion, The Transformer coupled audio power amplifier, Efficiency, Push-Pull amplifiers, Class B Amplifiers, Class AB operation, Class C amplifier.

Unit-III

Differential amplifiers **10 Periods**

The Differential amplifier, Basic BJT differential pair, DC transfer characteristic, small signal equivalent circuit analysis, differential and common mode gain, differential and common mode impedances, Bipolar transistor current sources, two transistor current sources, improved current source circuits, Widlar current source, multi transistor current mirrors.

SKILL DEVELOPMENT

Unit-IV

Applications of Operational Amplifiers: **10 Periods**

Review of basics of Op-Amp, Basic op-amp applications, Differential DC amplifier, Stable AC coupled amplifier, Analog Integration and differentiation, comparators, sample and hold circuits, Precision AC/DC converters, Logarithmic amplifiers, waveform generators, regenerative comparators, Instrumentation amplifier.

Unit-V

FET Amplifiers **12 Periods**

MOSFET DC circuit analysis, The MOSFET amplifier - small signal equivalent circuit, Common source amplifier, source follower amplifier, Common Gate amplifier. NMOS amplifiers with enhancement load, depletion load and PMOS load, CMOS source follower and common gate amplifiers.

SKILL DEVELOPMENT

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.[unit-1,unit-2,unit-4]
2. Donald A. Neamon, “Electronic Circuit Analysis and Design”, 2nd Edition. TMG publications. [unit-3,unit-5]

References:

1. Ramakanth A Gayakwad, “Op-Amps and Linear Integrated Circuits”- 4th Edition.

DIGITAL ELECTRONICS	
ECE 223	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student should be able to:	
1	Perform number conversions between different number systems and codes and apply Boolean algebra to minimize logic expressions up to three variables.
2	Analyze the characteristics of logic families and compare their performance in terms of performance metrics.
3	Apply tabulation method to minimize logic expressions up to Five variables and design a combination logic circuit like decoders, encoders, multiplexers, and de-multiplexers etc. for a given specification and verify the correctness of the design.
4	Analyze the operation of sequential circuits built with various flip-flops by finding the Boolean function or truth table and design various sequential circuits like flip-flops, registers, counters etc.
5	Design of sequential detector by constructing a state/output tables or diagrams from a word description or flow chart specification of sequential behavior using either mealy and/or Moore machines.,,

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	1	1	-	-	-	-	-	-	-	-	-	3	-	2
	2	1	2	2	-	-	-	-	-	-	-	-	-	3	-	2
	3	1	2	2	-	-	-	-	-	-	-	-	-	3	-	2
	4	1	2	2	-	-	-	-	-	-	-	-	-	3	-	2
	5	1	2	2	-	-	-	-	-	-	-	-	-	3	-	2

SYLLABUS

UNIT-I **10 periods**

NUMBER SYSTEMS: Number representation, Conversion of bases, Binary Arithmetic, Representation of Negative numbers, Binary codes: weighted and non-weighted, Error detecting and correcting codes -- Hamming codes.

BOOLEAN ALGEBRA: Basic definitions, Axiomatic Definitions, Theorems and properties, Boolean Functions, Canonical and standard forms.

UNIT-II **10 periods**

LOGIC FAMILIES

Binary Logic, AND, OR, NOT, NAND, NOR, EX-OR and Equivalence gates. Introduction, Specifications of digital circuits, RTL and DTL circuits, Transistor-Transistor Logic (TTL), Emitter Coupled Logic (ECL), MOS, CMOS circuits, Performance comparison of logic families.

UNIT-III **14 periods**

GATE-LEVEL MINIMIZATION

The Map Method: Two variable map, Three variable map, four variable map, Prime Implicants, Don't care conditions, NAND and NOR implementation, Exclusive-OR Function, Parity Generation and Checking, Variable Entered Mapping (VEM): Plotting Theory, Reading Theory, Quine-Mccluskey (QM) Technique.

Skill Development

COMBINATIONAL LOGIC

Combinational circuits, Analysis Procedure, Design procedure, Binary Adder-Subtractor, Decimal adder, carry look ahead adder, Binary Multiplier, Magnitude comparator, Decoders, Encoders, Multiplexers, ROM, PLA, PAL.

Skill Development

UNIT-IV **14 periods**

SYNCHRONOUS SEQUENTIAL LOGIC

Block diagram of sequential circuit, Latches, Flip-flops, Triggering of Flip-flops, Flip-flop excitation tables, Analysis of clocked sequential circuits, State equations, state table, state diagram, analysis with D, JK and T-Flip-flops, state machines, state reduction and assignment, Design procedure.

Skill Development

REGISTERS AND COUNTERS

Registers, Shift registers, universal shift register Ripple counters, Synchronous counters, counter with unused states, Ring counters, Johnson counter.

UNIT-V **12 periods**

ASYNCHRONOUS SEQUENTIAL LOGIC

Analysis Procedure, Circuits with latches, Design procedure, Reduction of state and flow tables, cycles, Race-Free state Assignment, Hazards, Design example.

Text Books:

1. M. Morris Mano, Digital Design, 3rd Edition, Pearson Publishers, 2001.
2. Z Kohavi, Switching and Finite Automata Theory, 2nd edition, TMH, 1978

Reference Books:

1. William I. Fletcher, An Engineering Approach to Digital Design, PHI, 1980.
2. John F. Wakerly, Digital Design Principles and Practices, 3rd Edition, Prentice Hall, 1999.
3. Charles H Roth Jr and Larry L. Kinney, Fundamentals of Logic Design, Cengage learning, 7th Edition, 2013
4. R.P Jain, Modern Digital Electronics, 3rd Edition, TMH, 2003.

PROBABILITY THEORY AND RANDOM PROCESSES	
ECE 224	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student should be able to:	
1	Calculate probabilities and conditional probabilities of events defined on a sample space.
2	Compute statistical averages of one random variables using probability density and distribution functions and also transform random variables from one density to another
3	Compute statistical averages of two or more random variables using probability density and distribution functions and also perform multiple transformations of multiple random variables.
4	Determine stationarity and ergodicity and compute correlation and covariance of a random process.
5	Compute and sketch the power spectrum of the response of a linear time-invariant system excited by a band pass/band-limited random process.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3		3								2	2	2	1
	2	3	3		3								2	2	2	1
	3	3	3										2	2	2	1
	4	3	3										2	2	2	1
	5	3	3										1	2	2	1

SYLLABUS

UNIT-I Probability and Random Variable **12Periods**

Probability: Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events.

Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables.

UNIT –II Distribution & Density Functions and Operation on One Random Variable **12 Periods**

Distribution & Density Functions: Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density, and Properties.

Operation on One Random Variable: Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and

Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable.

UNIT-III Multiple Random Variables and Operations **12 Periods**

Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem (Proof not expected), Unequal Distribution, Equal Distributions.

Operations on Multiple Random Variables: Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT-IV Random Process - Temporal Characteristics **12 periods**

Introduction, The Random Process Concept: Classification of Process, Deterministic and Nondeterministic Process. Stationary and Independence: Distributions and Density Functions, Statistical Independence, First-order Stationary Process, Second-Order and Wide-sense Stationary, N-Order and Strict-Sense Stationary, Time Averages and Ergodicity, Mean-Ergodic Process, Correlation-Ergodic Process. Correlation Functions: Autocorrelation Functions and Its Properties, Cross-correlation Functions and its properties, Covariance Functions, Discrete-Time Process and Sequences. Measurement of Correlation Functions, Guassian Random Process, Poisson Random Process, Complex Random Process.

Employability

UNIT-V Spectral Analysis **12 periods**

The Power Spectrum, Linear System, Hilbert Transform, Discrete Time Process, Modulation: Rice's Representation, Band pass processes, Band limited Processes and Sampling Theory.

Employability

Text Book:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, 4Ed., 2001, McGraw Hill.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, McGraw Hill, 4th Edition, 2002.

Reference Book:

1. Probability Theory and Random Processes, S. P. Eugene Xavier, S. Chand and Co. New Delhi, 1998 (2nd Edition).
2. Probability, Statistics, and Random Processes for Engineers- Henry Stark & John W. Woods, 4Ed, 2012, Pearson
3. Introduction to Random Signals and Noise, Davenport W. B. Jrs. and W. I. Root, McGraw Hill N.Y., 1954.

ELECTROMAGNETIC FIELD THEORY & TRANSMISSION LINES	
ECE 225	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student should be able to:	
1	Apply vector calculus to static electric fields in different engineering situations
2	Solve the problems related to magnetostatic fields by applying magnetostatic laws.
3	Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.
4	Analyze the phenomena of wave propagation in different media.
5	Apply the concepts of transmission line and use smith chart to find various parameters useful to design a matching circuits at radio frequency

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	1									2	2	2	1
	2	3	2	1									2	2	2	1
	3	3	2	1									3	2	2	2
	4	3	2	1									2	2	2	2
	5	3	2	3									3	2	2	3

SYLLABUS

UNIT I Electrostatics **14 periods**

Introduction to vector analysis, Fundamental of electrostatic fields, Different types of charge distributions, Coulomb's law and Electric field intensity, Potential function, Equi-potential surface, Electric field due to dipole; Electric flux density, Gauss's law and applications, Poisson's and Laplace's equations and its applications; Uniqueness theorem; Boundary conditions; Conductors & Dielectric materials in electric field; Current and current density, Relaxation time, Relation between current density and volume charge density; Dipole moment, Polarization, Capacitance, Energy density in an electric field.

UNIT II Steady Magnetic Fields **12 periods**

Introduction, Faradays law of induction, Magnetic flux density, Biot-Savart law, Ampere's circuit law, Magnetic Force, Magnetic Boundary conditions, Scalar and Vector magnetic potentials, Magnetization & Permeability in materials, Inductance, Energy density, Energy stored in inductor.

UNIT III Maxwell's Equations **10 periods**

Introduction, Faradays law, displacement current, Equation of continuity for the varying fields, inconsistency of Amperes circuit law, Maxwell's equations in integral form, Maxwell's equations in point form, retarded potentials Meaning of Maxwell's equations, conditions at a Boundary surfaces, Retarded potentials.

UNIT IV Electromagnetic Waves **10 periods**

Introduction, Applications of EM waves, solutions for free space condition ,; Uniform plane wave propagations uniform plane waves, wave equations conducting medium, sinusoidal time variations, conductors & dielectrics, Depth of penetration, Direct cosines, Polarization of a wave, reflection by a perfect conductor – Normal incidence, Oblique incidence, reflection by a perfect dielectric-Normal incidence, reflection by a perfect insulator – oblique, Surface impedance, Poynting vector and flow of power, Complex poynting vector.

skill development

UNIT V Transmission Lines **10 periods**

Types of transmission lines, Applications of transmission lines, Equivalent circuit of pair of transmission lines, Primary constants, Transmission line equations, Secondary constants, lossless transmission lines, Distortionless line, Phase and group velocities, Loading of lines, Input impedance of transmission lines, RF lines, Relation between reflection coefficient, Load and characteristic impedance, Relation between reflection coefficient and voltage standing wave ratio (VSWR), Lines of different lengths - $\lambda/8$, $\lambda/4$, $\lambda/2$ lines, Losses in transmission lines, Smith chart and applications, Stubs, Double stubs.

Skill development

Text Books:

1. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 2nd Ed., 2000.

2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", TMH, 7th Ed., 2006.

Reference Books:

1. G.S.N.Raju, Electromagnetic Field Theory And Transmission Lines, Pearson Education (Singapore) Pvt., Ltd., New Delhi, 2005.
2. M.N.O. Sadiku, " Principles of Electromagnetics", Oxford International Student edn., 4th edn., 2007.
3. G. Sasi Bhushana Rao, "Electromagnetic Field Theory andTransmission Lines", Wiley, India Pvt. Ltd, 2012.
4. Simon Ramo, et.al-, "Fields and waves in communication electronics", Wiley India Edn., 3rd Edn., 1994

CONTROL SYSTEMS	
ECE 226	**Credits:3**
Instruction: 3 Periods & 1 Tut/Week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Course Outcomes:

By the end of the course student should be able to:	
1	Apply block reduction techniques and signal flow graphs
2	Apply mathematical modelling of mechanical and electrical systems
3	Analyze the given systems in time domain
4	Determine the relative and steady state stability of the systems
5	Analyze the systems in frequency domain

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	3	2	1	-	-	-	-	-	-	-	-	1	-	1	-	2
	4	2	1	-	-	-	-	-	-	-	-	1	-	1	-	2
	5	2	2	-	-	-	-	-	-	-	-	1	-	1	-	2

SKILL DEVELOPMENT

SYLLABUS

UNIT-I Introduction to Control Systems **12 Periods**

Transfer Functions of Linear Systems - Impulse Response of Linear Systems-Block Diagrams of Control Systems-Signal Flowgraphs (Simple Problems) - Reduction Techniques for Complex Block Diagrams and Signal Flow Graphs (Simple Examples).

SKILL DEVELOPMENT

UNIT-II Modeling of Control Systems **10 periods**

Introduction to Mathematical Modelling of Physical Systems - Equations of Electrical Networks - Modelling of Mechanical Systems - Equations of Mechanical Systems.

UNIT-III Time domain analysis **16 periods**

Time Domain Analysis of Control Systems - Time Response of First and Second Order Systems with Standard Input Signals-Steady State Performance of Feedback Control Systems-Steady State Error Constants-Effect of Derivative and Integral Control on Transient and Steadystate Performance of Feedback Control Systems.

SKILL DEVELOPMENT

UNIT-IV Concept of stability in time domain **12 periods**

Concept of Stability and Necessary Conditions for Stability - Routh - Hurwitz Criterion, Relative Stability Analysis, The Concept and Construction of Root Loci, Analysis of Control Systems With Root Locus (Simple Problems to Understand Theory)

SKILL DEVELOPMENT

UNIT-V Frequency domain analysis **14 periods**

Correlation Between Time and Frequency Responses - Polar Plots - Bode Plots - Log Magnitude Versus Phase Plots-All Pass and Minimum Phase Systems-Nyquist Stability Criterion-Assessment of Relative Stability-Constant M&N Circles.

SKILL DEVELOPMENT

Text books:

1. I.J. Nagrath & M.Gopal, "Control systems engineering", wiley eastern limited.
2. Benjamin C. Kuo, "Automatic control systems", prentice hall of India

References:

1. Ogata, "Modern control engineering", prentice hall of India.

ELECTRONIC CIRCUITS AND ANALYSIS-II LABORATORY	
ECE 227	**Credits:2**
Instruction: 3 Practical's /Week	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Course outcomes:

By the end of the course student should be able to:	
1	Design and identify the applications of feedback amplifiers and sinusoidal oscillators in different electronic circuits.
2	Design and implement different power amplifiers and tuned voltage amplifiers.
3	Calculate the parameters of BJT differential amplifier.
4	Apply op-amps fundamentals in design and analysis of op-amps applications.
5	Apply the MOSFET inverter in different electronic circuits.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	2	2	-	-	-	-	-	2	-	-	2	-	2
	2	2	2	2	2	-	-	-	-	-	2	-	-	2	-	2
	3	1	2	2	1	-	-	-	-	-	2	-	-	2	-	2
	4	2	2	3	2	-	-	-	-	-	2	-	-	2	-	2
	5	2	1	2	2	-	-	-	-	-	2	-	-	2	-	2

LIST OF EXPERIMENTS

1. Obtain the input and output impedance of a trans-conductance amplifier with and without feedback.
2. Obtain the frequency response of a voltage shunt negative feedback amplifier with and without feedback.
3. Generate a sinusoidal signal using Colpitts oscillator at a desired frequency.
4. Generate a sinusoidal signal using Wein bridge circuit.
5. Generate a sinusoidal signal using RC phase shift oscillator and observe the lissajous patterns at different phase shifts.

SKILL DEVELOPM

6. Plot the frequency response of a tuned voltage amplifier and find the resonant frequency.
7. Obtain the output waveforms of a class-B pushpull power amplifier and calculate the efficiency and distortion.
8. Obtain the output waveforms of a class-A transformer coupled power amplifier and calculate the power conversion efficiency.
9. Determine the gain and CMRR for the BJT differential amplifier.
10. Obtain the signals at the output junctions of multistage BJT differential pair.
11. Verify different applications of an Operational amplifier.
12. Verify different parameters of an operational amplifier.
13. Observe the working of an operational amplifier in inverting, non inverting and differential modes.
14. Plot the V-I characteristics of an n-channel enhancement MOSFET and verify its operation as an inverter.

SKILL DEVELOPMENT

15. Verify the working of a CMOS source follower amplifier.

Text books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.
2. Donald A. Neamon, “Electronic Circuit Analysis and Design”, 2nd Edition. TMG publications.

References:

1. Ramakanth A Gayakwad, “Op-Amps and Linear Integrated Circuits”- 4th Edition.

SIMULATION LABORATORY	
ECE 228	**Credits:2**
Instruction: 3 Practical's /Week	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Course outcomes:

By the end of the course student should be able to:	
1	Calculate the convolution and correlation between signals
2	Plot magnitude and phase spectrum of a given signal using various transformation tools.
3	Generate random sequences for a given distribution.
4	Understand the basics of VHDL and describe the logic circuit using different types of models in the architecture of the body.
5	Design and simulate combinational and sequential circuits using VHDL

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	-	-	1	3	-	-	-	-	2	-	-	2	2	1
	2	2	-	-	1	3	-	-	-	-	2	-	-	2	2	1
	3	2	-	-	1	3	-	-	-	-	2	-	-	2	2	1
	4	2	-	-	1	3	-	-	-	-	2	-	-	2	2	1
	5	2	-	3	1	3	-	-	-	-	2	-	-	2	2	2

LIST OF EXPERIMENTS

Cycle-I (MATLAB)

1	Basic Operations on Matrices.
2	Write a program for Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit impulse, unit step, square, saw tooth, triangular, sinusoidal, ramp, sinc.
3	Write a program to perform operations like addition, multiplication, scaling, shifting, and folding on signals and sequences and computation of energy and average power.
4	Write a program for finding the even and odd parts of signal/ sequence and real and imaginary parts of signal.
5	Write a program to perform convolution between signals and sequences.
6	Write a program to perform autocorrelation and cross correlation between signals and sequences.
7	Write a program for verification of linearity and time invariance properties of a given continuous/discrete system
8	Write a program for computation of unit samples, unit step and sinusoidal response of the given LTI system and verifying its physical realiazability and stability properties.
9	Write a program to find the Fourier transform of a given signal and plotting its magnitude and Phase spectrum.
10	Write a program for locating the zeros and poles and plotting the pole-zero maps in S plane and Z-plane for the given transfer function.
11	Write a program for Sampling theorem verification.

12	Write a program for Removal of noise by autocorrelation / cross correlation.
13	Generation of random sequence
14	Write a program to generate random sequence with Gaussian distribution and plot its pdf and CDF .
15	Write a program for verification of winer- khinchine relations.
16	Let Z be the number of times a 6 appeared in five independent throws of a die. Write a program to describe the probability distribution of Z by: Plotting the probability density function Plotting the cumulative distribution function
17	Plot the probability mass function and the cumulative distribution function of a geometric distribution for a few different values of the parameter p. How does the shape change as a function of p?
18	Write a program to generate 10,000 samples of an exponentially distributed random variable using the simulation method. The exponential random variable is a standard one, with mean 10. Plot also the distribution function of the exponentially distributed random variable using its mathematical equation.
19	Write a program to determine the average value and variance of Y=exp(X), where X is a uniform random variable defined in the range [0, 1]. Plot the PDF of Y
20	Consider the random process defined as X[n] = 2U [n] − 4U [n − 1], where U [n] is a white noise with zero mean and variance σ2 = 1. Generate a realization of 1000 samples of X[n] by using MATLAB. Based on this realization, estimate the power spectral density and plot the estimate.

Cycle-II (VHDL modeling and simulation of the following experiments using ModelSim)

1.	Realization of logic gates
2.	Verifying the functionality of half adder and full adder using basic gates and universal gates.
3.	Verifying the functionality of half subtractor and full subtractor using basic gates and universal gates.
4.	Design of 4-bit magnitude comparator
5.	Design of Multiplexers/De-multiplexers
6.	Decoders , Encoders
7.	Code converters
8.	Verifying the functionality of JK,D and T- Flipflops
9.	Design of synchronous counter using the given type of flip flop
10.	Design of asynchronous counter using the given type of flip flop

Note: A minimum of any ten experiments have to be done from cycle-I and any six experiments from cycle-II

Skill development

Text Books:

1. Rudra Pratap, "Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers " Oxford 2010.
2. J Bhaskar,"VHDL Primer" 3rd Edition ,Prentice Hall 1999

References:

1. J G Proakis, VK Ingle, "Digital signal processing using MATLAB", 3rd Edition, Cengage learning.

INTRODUCTION TO EMBEDDED SYSTEMS	
ECE 311(a)	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To introduce the student to the basics of embedded systems
- To learn about the components of embedded systems
- To familiarize the student with embedded systems by providing examples from various fields

Course Outcomes:

By the end of the course, the student will be able to:	
1.	learn about the general principles of computer architecture
2.	learn about the working of a simple embedded system and embedded system applications
3.	learn the hardware aspects of embedded systems
4.	understand the sensors, ADCs and actuators used in embedded systems
5.	understand the real world examples of embedded systems

Mapping of Course Outcomes with Program Outcomes:

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**	2	-	-	-	-	-	-	-	-	-	-	1
	2	2	-	-	-	-	-	-	-	-	-	-	1
	3	2	-	-	-	-	-	-	-	-	-	-	1
	4	2	1	-	-	-	-	-	-	-	-	-	2
	5	3	2	-	-	-	-	-	-	-	-	-	2

SYLLABUS

UNIT I: **8 Periods**

Basics of computer architecture and the binary number system

Basics of computer architecture, computer languages, RISC and CISC architectures, number systems, number format conversions, computer arithmetic, units of memory capacity

UNIT II: **8 Periods**

Introduction to embedded systems

Application domain of embedded systems, desirable features and general characteristics of embedded systems, model of an embedded system, microprocessor Vs microcontroller, example of a simple embedded system, figure of merit for an embedded system, classification of MCUs: 4/8/16/32 bits, history of embedded systems, current trends

Employability

UNIT III: **10 Periods**

Embedded systems-The hardware point of view

Microcontroller unit(MCU), a popular 8-bit MCU, memory for embedded systems, low power design, pull up and pull down resistors

Employability

UNIT IV: **12 Periods**

Sensors, ADCs and Actuators

Sensors: Temperature Sensor, Light Sensor, Proximity/range Sensor; Analog to digital converters: ADC Interfacing; Actuators Displays, Motors, Opto couplers/Opto isolators, relays.

UNIT V: **12 Periods**

Examples of embedded systems

Mobile phone, automotive electronics, radio frequency identification (RFID), wireless sensor networks(WISENET), robotics, biomedical applications, brain machine interface

Text Books:

1. Lyla B Das, *Embedded systems: An Integrated Approach*, 1st Ed., Pearson, 2013

Reference Books:

1. Shibu, K.V., *Introduction to Embedded Systems*, 1st Ed., TMH, 2009
2. Kanta Rao B, *Embedded Systems*, 1st Ed., PHI
3. Frank Vahid & Tony Givargis, *Embedded System Design*, 2nd Edition, John Wiley,

COMMUNICATION SYSTEMS ENGINEERING	
ECE 312	**Credits: 4**
Instruction: 4 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites:

Engineering Mathematics, Signals and Systems, Electronic Circuit Analysis.

Course Outcomes:

By the end of the Course, the students will be able to:	
1.	Analyze about various blocks in a Communication System.
2.	Analyze and design the analog modulator and demodulator circuits.
3.	Apply the concepts to explain about various blocks in Transmitters and Receivers.
4.	Analyze and design the pulse analog modulation techniques and evaluate the performance of analogue communication systems in the presence of noise.
5.	Gain knowledge of satellite orbits, its launching methods, Link design, earth segment and space segment components.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	3	2	3	-	-	-	-	-	-	1	-	2	3	2	3
	2.	3	3	3	-	-	-	-	-	-	1	-	3	3	3	3
	3.	3	3	3	-	-	-	-	-	-	1	-	2	3	3	2
	4.	3	3	3	-	-	-	-	-	-	1	-	3	3	2	2
	5.	3	3	1	-	-	-	-	-	1	1	-	3	3	1	3

SYLLABUS

UNIT I **15 periods**

Introduction to Communication Systems:

Basic Block Diagram of Communication Systems; Principles of Analog and Digital Communication; Linear Modulation Systems: Need for Modulation, Frequency Translation, Method of Frequency Translation, Amplitude Modulation, Modulation Index, Spectrum of AM Signal, Square law modulator and diode detector, DSB-SC Signal and its Spectrum, Balanced Modulator, Synchronous Detectors, Costas loop, Hilbert transform , properties & applications, SSB Signal, SSB Generation Methods, Power Calculations in AM Systems, VSB, Applications of AM Systems.

UNIT II **15 periods**

Non Linear Modulation Systems:

Angle Modulation, Phase and Frequency Modulation and their Relationship, Phase and Frequency Deviation, NBFM, WBFM, Spectrum of an FM Signal, Bandwidth of Sinusoidal Modulated FM Signal, Carson's rule, Effect of the Modulation Index on Bandwidth, Comparison of FM and PM; Generation of FM Waves: Direct Method-Varactor diode, Indirect Method-

Armstrong Method; Detection of FM Waves: Balanced Frequency discriminator, Phase locked loop, Comparison of FM and AM.

UNIT-III **10 periods**

Radio Transmitters & Receivers: Radio Transmitters: AM and FM Transmitters, SSB Transmitters; Radio receiver: Tuned radio frequency receiver, Superhetrodyne receiver, AM Receivers – RF Section, Frequency Changing and Tracking, Intermediate Frequency and IF Amplifiers, Automatic Gain Control (AGC); FM Receivers – Amplitude Limiting.

UNIT-IV **15 periods**

Noise & Noise performance of AM & FM systems:
Thermal noise, shot noise, Flicker Noise and Transition Noise, Signal to Noise ratio, Noise equivalent bandwidth, Noise equivalent temperature , Noise figure , Figure of merit, Noise in AM Systems: DSB-SC, SSB-SC, AM with carrier (Envelope Detector); Noise in FM, pre-emphasis & De-emphasis, threshold effect, problems.**Analog Pulse Modulation Techniques:**Pulse modulation and its types, PAM, PWM, PPM, concepts of Time Division Multiplexing, Frequency Division Multiplexing.

UNIT-V **10 periods**

Satellite Communications:
Introduction, History of Satellites, Kepler's laws, Satellite orbits, Geosynchronous Satellites, Launch vehicle, `Antenna look angle, Satellite system link models- Uplink, Transponder, Down link model, Cross-Links, satellite system parameters, satellite system Link equations, satellite system Link Budget.

Text Books

1. B. P. Lathi, "*Modern Digital and Analog Communication Systems*," 2nd Edition, Oxford University Press, 2010.
2. Simon Haykins, "*Communication Systems*," Wiley, Fifth edition, 2009.
3. P.Ramakrishna Rao, "*Analog communications*" Tata McGraw Hill Education Private Limited. 2011.

Reference Books

1. H P Hsu, "*Analog and digital communications*" Schaum's outlines, McGraw-Hill Education; 2 edition, 2002.
2. Wayne Tomasi, "*Electronic Communications Systems: Fundamentals Through Advanced*,"- Pearson Education, Fifth Edition, 2011.
3. Robert J. Schoenbeck, *Electronic Communications Modulation and Transmission*, PHI N. Delhi, 1999.
4. G. Kennedy, "*Electronic Communication Systems*," McGraw Hill, 2nd Edition, 1977.

MICROPROCESSORS AND APPLICATIONS	
ECE 313	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Digital Electronics.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Able to program 8085 microprocessor to meet the specific requirements of the client
2.	Able to organize the hardware involved in BIU & EU of 8086 microprocessor & analyze the minimum and maximum mode 8086 systems using timing diagrams
3.	Able to program 8086 microprocessor to meet the specific requirements of the client
4.	Able to interface 8086 microprocessor to semiconductor memories (SRAM & EPROM), stepper motor to meet the specific requirements of the Client, Also able to generate a specific waveform by designing an interface between a CRO and 8086 microprocessor & able to convert a given analog sample value into its equivalent digital value by designing an interface between 8086 microprocessor and analog input using A/D converter to meet the meet the specific requirements of the Client
5.	Able to design interface between peripheral devices and 8086 microprocessor using 8259 (Programmable Interrupt Controller) to get services from 8086 microprocessor on Interrupt basis & able to interface USART to 8086 to perform serial communication.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	1	-	1	-	-	-	-	-	-	-	-	-	3	-	2
	2	2	-	2	-	-	-	-	-	-	-	-	-	3	-	2
	3	2	-	2	-	-	-	-	-	-	-	-	-	3	-	2
	4	2	-	2	-	-	-	-	-	-	-	-	-	3	-	2
	5	2	-	2	-	-	-	-	-	-	-	-	-	3	-	2

SYLLABUS

UNIT I: **16 Periods**

Overview of 8085 (Architecture & Instruction Set):

Introduction to Microprocessors and Microcomputers, Internal Architecture and Functional Description of INTEL 8085 Microprocessor, Interrupt Structure of 8085, Instruction Set of 8085 µP and Sample programs.

Employability

UNIT II: **08 Periods**

8086 Architecture:

Architecture of 8086, Register organization, Memory segmentation. Physical memory organization. signal description of 8086, Minimum mode 8086 system and timings, Maximum mode 8086 system and timings.

UNIT III: **15 Periods**

Instruction Set and Assembly Language Programming of 8086:
Addressing modes, instruction set, assembler directives(Significant), macros and operators. Simple programs involving arithmetic, logical, branch and string manipulation instructions.

Employability

UNIT IV: **09Periods**

Interfacing – I:
Memory interfacing to 8086 (Static RAM & EPROM).
Methods of parallel data transfer, 8255A Internal block diagram and system connections, 8255A operational modes and initialization, constructing and sending 8255A control words, interfacing to 8086. Interfacing Stepper motor, D/A and A/D converters

Employability

Employability

UNIT V: **08 Periods**

Interfacing – II:
8086 Interrupts and response, Interrupt vector table, Types of Interrupts, 8259 PIC Architecture and interfacing, cascading of interrupt controller to 8086, 8253/8254, modes of 8253 & Interfacing.
Serial data transfer schemes: Asynchronous and Synchronous data transfer schemes. 8251 USART architecture and interfacing to 8086. RS-232.

Employability

Text Books:

1. Ramesh S. Gaonkar, *Architecture Programming and Applications*, 3rd Edition, Penram International Pvt. Ltd.
2. D. V. Hall, *Microprocessors and Interfacing*, Revised 2nd edition 2006, TMH,.
3. A.K. Ray and K.M. Bhurchand, *Advanced Microprocessors and Peripherals*, 2nd edition, 2006, TMH.

Reference Books:

1. John Uffenbeck, *The 8086/8088 Family: Design, Programming And Interfacing*, PHI
2. N. Senthil Kumar, M. Saravanan, and S. Jeevananthan, *Microprocessors and Microcontrollers*, OUP India

COMPUTER ARCHITECTURE AND ORGANIZATION	
ECE314	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Digital Electronics.

Course Objectives:

- To learn how computers work, how to analyze their performance, how computers are designed.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Work with the typical assembly language instructions of a computer
2.	Organize the hardware involved in the CPU of a computer
3.	Design CPU & control unit of a basic computer
4.	Use computing resources such as memory and I/O in an effective manner to improve the performance of a computer
5.	Illustrate the concept of pipelining and multiprocessors

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	-	-	-	-	-	-	-	-	-	-	-	2	2	3
	2	1	2	2	-	-	1	-	-	-	-	-	-	3	2	3
	3	1	2	2	-	-	1	-	-	-	-	-	1	2	3	3
	4	1	-	-	-	-	-	1	-	-	-	-	1	1	1	2
	5	1	1	-	-	-	-	-	-	-	-	-	-	1	1	1

SYLLABUS

UNIT I : 9 Periods

Register Transfer and Microoperations :

Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit

UNIT II : 12 Periods

Basic Computer Organization :

Instruction Codes, Computer Registers, Computer Instructions, hardwired control unit, Instruction Cycle, Memory Reference Instructions

Microprogrammed Control :

Control Memory, Address Sequencing, Microinstruction Formats, Micro program Example, Design of Control Unit

UNIT III : **9 Periods**

CPU Organization

Introduction, General Register Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, , Stack Organization. Reduced Instruction Set Computer(RISC) and CISC architectures

UNIT IV : **9Periods**

Memory Organization

Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory

UNIT V : **11 Periods**

Input - Output Organization

Peripheral Devices, Input - Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA),Introduction to pipelining, multiprocessors

Text Book

1. M. Morris Mano, *Computer System Architecture*, 3rd Ed., PHI, 1996

Reference Books

1. V. Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaky, *Computer Organization*, 5th Ed., McGraw Hill International, 2011
2. Sivarama P. Dandamudi, *Fundamentals of computer Organization and design*, Springer, 2002
3. William Stallings, *Computer Organization & Architecture - Designing for performance*, 8th Ed., Pearson Education India, 2013
4. John D. Carpinelli, *Computer Systems Organization & Architecture*, 1st Ed., Pearson Education India, 2000
5. Sajjan G. Shiva, *Computer design and architecture*, 3rd Ed., Marcel Dekker, 2000
6. Hennessy- Patterson, *Computer Architecture: A quantitative approach*, 5 th edition, Morgan Kaufmann, 2011

INTEGRATED CIRCUITS AND APPLICATIONS	
ECE315	**Credits:3**
Instruction: 3 periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites:
Network Theory and Synthesis, Electronic Circuits and Analysis-II

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Analyze the static and dynamic electrical behavior of CMOS circuits.
2.	Design and analyze active filters of an op-amp& IC Voltage regulators
3.	Design circuits for several applications using IC 555 Timer, PLL, analog multiplier ICs etc.
4.	Design several circuits using D/A and A/D convertor.
5.	Design the combinational and Sequential circuits using digital ICs.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	2	-	-	-	-	-	-	-	-	1	1	1	1
	2	2	2	2	-	-	-	-	-	-	-	-	1	1	1	1
	3	3	2	2	-	-	-	-	-	-	-	-	1	1	1	1
	4	2	2	2	-	-	-	-	-	-	-	-	1	1	1	1
	5	2	2	2	-	-	-	-	-	-	-	-	1	1	1	1

SYLLABUS

UNIT I: **12 Periods**

Digital Circuits:
CMOS logic, electrical behavior of CMOS circuits-Static and Dynamic, Low -Voltage CMOS logic and interfacing, CMOS/TTL interfacing

UNIT II: **12 Periods**

Voltage regulators & Active Filters:
IC Voltage regulators - Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator
Filter Fundamentals: Filter types, Realizing Practical Filters: Sallen-Key LPF and HPF Realizations-BPF Realization-Notch Filter (Band Reject) Realization - All Pass Filters, Switched Capacitor filter

UNIT III:

Timer, Phase Locked Loop and Analog Multiplier: **12 Periods**
IC 555 Timer: Functional block diagram and description, Monostable, Astable operation and their applications, 556 Voltage Controlled Oscillator - -Phase Locked Loop-Operation of 565 PLL-Closed loop analysis of PLL- PLL Applications: Frequency Synthesis - Frequency Translation - AM and FM detection, analog multiplier ICs.

UNIT IV: **12 Periods**

Analog to Digital and Digital to Analog Converters :

Digital to Analog converters - Binary weighed and R-2R Ladder types - Analog to digital converters - Continuous - Counter ramp, successive approximation, single, dual slope and parallel types

UNIT V: **12 Periods**

Combinational Logic ICs - Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs, Code Converters, Decoders, Demultiplexers, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers

Sequential Logic ICs: Familiarity with commonly available 74XX & CMOS 40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Text Books:

1. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001
2. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", New Age Science, 2010
3. John F Wakerly, “Digital Design-Principles and practices”, 4^{th} Ed., Pearson, 2008

Reference Books:

1. Ramakant A. Gayakwad, "OP - AMP and Linear IC's ", Prentice Hall, 2002.
2. Sonde, B.S, “Introduction to System Design using Integrated Circuits”, Second Edition, Wiley Eastern Limited, New Delhi, 1994
3. Michael Jacob J., "Applications and Design with Analog Integrated Circuits ", Prentice Hall of India, 1996.
4. Robert F Coughlin and Fedrick F Driscoll ―Operational amplifiers and linear Integrated Circuits‖, 6th edition, Prentice Hall of India, New Delhi, 2006.
5. Richard J. Higgins "Electronics with Digital and Analog Integrated Circuits‖, Prentice Hall of India, New Delhi, 1983.
6. George Clayton and. Steve Winder - Operational Amplifiers, 5th edition. Elsevier, 2003
7. Sergio Franco - Design with operational amplifiers and analog integrated circuits, 3rd ed., McGraw-Hill Education, 2001

ANTENNAS AND WAVE PROPAGATION	
ECE 316	**Credits : 3**
Instruction : 3 periods & 1 Tutorial/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: EMFT

Course Outcome:

By the end of the course, the students will be able to:	
1	Analyze the basic antenna parameters by applying the concepts & properties of electromagnetism
2	Determine the fundamental parameters of practical antennas operating at various frequencies from LF to Microwave applications.
3	Analyze & design the linear antenna arrays.
4	Assess antenna performance by using suitable measurement technique.
5	Identify & Analyze the characteristics of radio wave propagation.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1	3	2	2	-	-	1	1	-	-	-	-	1	1	2	2
	2	3	3	2	-	-	1	1	-	-	-	-	2	3	3	2
	3	3	3	3	-	-	1	1	-	-	-	-	2	3	3	1
	4	2	2	1	-	-	-	-	-	-	-	-	1	1	1	1
	5	2	2	1	-	-	-	-	-	-	-	-	1	1	1	2

SYLLABUS

UNIT I **12 Periods**

Radiation Mechanism and Antennas Basics

Antenna definition, Functions of antennas , Network theorems, Properties of antennas, Antenna parameters. Radiation mechanism, Radiation fields of alternating current element, Radiated power and radiation resistance; Radiation, induction and electrostatic fields. Different current distributions in linear antennas, Radiation from half-wave dipole, quarter wave mono pole and their characteristics. Radiation patterns of alternating current element, dipoles and monopoles.

UNIT II **12 Periods**

Types of Antennas & Applications

Introduction, Isotropic radiators, Directional antennas, omnidirectional antennas, Resonant antennas, Non-resonant antennas, LF, HF, VHF and UHF antennas. Folded dipole, V-Antennas, Inverted V-antennas, Rhombic antenna, Yagi-Uda antenna, Log-periodic antennas, Loop antenna, Helical antennas. Microwave Antennas: Rod reflector, Plane reflector, Corner reflector, Parabolic reflector, Types of parabolic reflectors, Feed systems for parabolic reflectors, Shaped beam antennas, Horn antennas, Corrugated horns, Slot antennas, Slots in the walls of rectangular waveguides, Babinet's principle, Lens antennas, Microstrip antenna and feeding techniques.

UNIT III **12 Periods**

Analysis & Synthesis of Linear Arrays

Two-element uniform array, Uniform linear arrays, Field strength of a uniform linear array, First sidelobe ratio (SLR), Broadside and End-fire arrays, Patterns of array of non-isotropic radiators, Multiplication of patterns, Generalized expression for principle of pattern multiplication, Radiation pattern characteristics, Binomial arrays.Transmission loss between transmitting and receiving antennas - FRIIS formula, Antenna temperature and signal-to-noise ratio. Schelkunoff Synthesis methods, Fourier transform method, Linear array design by Woodward-lawson method, Dolph-chebychev method (Tschebyscheff distribution), Taylor method, Laplace transform method, Standard amplitude distributions. Introduction to planar & phased arrays.

Skill Development

UNIT IV **12 Periods**

Antenna Measurements

Introduction, Drawbacks of measurements of antenna parameters, Methods to overcome drawbacks in measurements, Methods for accurate measurements, TEM cell, GTEM cell, Anechoic chamber, Measurement ranges, Indoor and outdoor ranges, Antenna impedance measurements, Measurement of radiation resistance, Gain measurements, Measurement of antenna bandwidth, Directivity measurement, Measurement of sidelobe ratio, Measurement of radiation efficiency, Measurement of antenna aperture efficiency, Measurement of polarization of antenna, Phase measurement.

Skill Development

UNIT V **12 Periods**

Wave Propagations

Propagation characteristics of EM Waves, Factors involved in the propagation of radio waves, Ground wave propagation, Ground wave field strength by Maxwell's equations, Reflection of radio waves by the surface of the earth, Roughness of earth, Reflection factors of earth, Wave tilt of the ground wave, Tropospheric wave propagation, Atmospheric effects in space wave propagation, Duct propagation, Radio horizon, Troposcatter, Fading of EM waves in Troposphere, Line of sight (LOS), Ionospheric propagation, Characteristics of ionosphere, Refractive index of ionosphere, Phase and group velocities, Mechanism of Ionospheric propagation, reflection and refraction, Characteristic parameters of Ionospheric propagation, Sky wave field strength, Fading and diversity techniques, Faraday's rotation, Effect of earth's magnetic field.

Text Book

1. C.A. Balanis, *Antenna Theory*, John Wiley & Sons, NY, 3rd edn., 2005.
2. G.S.N. Raju, *Antennas and Wave Propagation*, Pearson Education (Singapore) Pvt., Ltd., New Delhi, 2007.

Reference Books:

1. E. C. Jordan and K. G. Balmain, *EM Waves and Radiation Systems*, PHI – N. Delhi,2nd Edn., 2000.
2. J.D. Kraus, *Antennas*, McGraw Hill, NY,2nd Edn., 1988.

MICROPROCESSORS & APPLICATIONS LABORATORY	
ECE 317	**Credits:2**
Instruction: 3 Lab periods	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites:

Microprocessors and Applications

Course Objectives:

- To program both 8085 and 8086 to meet the requirements of the user.
- To interface various peripherals
- To handle interrupts
- To design a microcomputer to meet the requirement of the user

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Program 8085 & 8086 microprocessor to meet the requirements of the user.
2.	Interface peripherals like switches, LEDs, stepper motor, Traffic lights controller, etc..,
3.	Handle interrupts
4.	Design a microcomputer to meet the requirement of the user

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1	2	2	2	-	-	-	2	1	-	1	2	2	2
	2	3	2	2	2	2	-	-	-	2	1	-	1	2	2	2
	3	2	2	2	2	1	-	-	-	2	1	-	1	1	1	2
	4	2	2	3	3	2	-	-	-	2	1	-	1	2	3	3

Employability

List of Experiments

Experiments using 8085 Microprocessor trainer:

1) Write a program, which loads Registers, A, B, C, and D with the same constant. Try to optimize the program in such a way that the smallest numbers of program bytes are used. Test the program in single step mode. After each step, test the register of interest.

   Assume that 4 bytes of data are stored at consecutive locations of the data-memory starting at (x). Write a program, which loads Registers E with (x), D with (x+l), C with (1+2) and A with (x+3).

   a. Assume that l byte of data is stored at data memory location (x). Write a program which tests bit 5 of (X). Write ‘FF’ in (x+1), if bit 5=0 and write ‘00’ at the same location if bit 5=1.
   b. Write a program which tests the zero-condition of a data byte specified at data memory location (x). If it is zero ‘00’ should be stored at (x+1) location, if non-zero ‘FF’ should be stored at the same location.

c. A binary number is stored at data-memory location (x) Compute the number of its logical 1's and store the result at y.
d. Comment on the instructions used in the above three programs and write about the effect of flags with the instructions used.

2) Two unsigned binary numbers are stored at data-memory locations (x) and (x+1).
   a. Compute the sum of the two numbers and store the result at y, ignoring the possible overflow.
   b. Write a program to compute (x+1) - (x). The magnitude of the result should be stored at (y) and the sign (00 if positive, 01 if negative) at (y+1). Understand the 2's compliment Arithmetic.
3) N binary numbers stored at consecutive data memory locations starting at (x) where N is defined at data memory location 'NUMBER'.
   a. Find the largest number and display it in the data field and arrange them in ascending order.
   b. Find the smallest number and display it in the data field and arrange them in descending order.
4) Two 8-bit binary numbers are stored at data memory locations (x) and (x+1) compute product of the two numbers using, a). Successive addition method. b). Shifting and adding method store the result in (y) and (y+1).

Experiments using 8086 Microprocessor trainer/TASM/MASM:

5) Addition of a) 16-bit numbers b) 32-bit numbers
6) Factorial of a number, Fibonacci series
7) Hexadecimal and decimal counters
8) Sorting of numbers

Interfacing experiments with 8086 Microprocessor trainer:

9) Interfacing of D/A converter   Employability
10) Interfacing of A/D converter
11) 8255 Study Card – Interfacing I/O Devices
12) Interfacing of stepper motor   Employability
13) Interfacing of 7-segment display/Traffic light controller

Note: A student has to perform a minimum of 10 experiments.

Text Books:

1. Ramesh S. Gaonkar, *Architecture Programming and Applications*, 3rd Edition, Penram International Pvt. Ltd.
2. D. V. Hall, *Microprocessors and Interfacing*, Revised 2nd edition 2006, TMH,.
3. A.K. Ray and K.M. Bhurchand, *Advanced Microprocessors and Peripherals*, 2nd edition, 2006, TMH.

INTEGRATED CIRCUITS LABORATORY	
ECE318	**Credits:2**
Instruction: 3 Lab periods	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites:
Digital Electronics, Integrated Circuits and Applications

Course Objectives:

- To understand the linear and non-linear applications of operational amplifiers(741)
- To familiarize with theory and applications of 555 timers.
- To design and construct waveform generation circuits using Op-Amp
- To design multivibrator circuits using IC555
- To design and analyze combinational and sequential logic circuits

Course Outcomes:

By the end of the course, the student will be able to	
1.	Design the circuits using op-amps for various applications like adder, subtractor, integrator, differentiator and Schmitt trigger
2.	Design active filters for the given specifications and obtain their frequency response characteristics.
3.	Design and analyze multivibrator circuits using op-amp and 555Timer
4.	Design and analyze various combinational circuits like multiplexers, and de-multiplexers, binary adder, subractor, etc
5.	Design and analyze various sequential circuits like flip-flops, counters etc

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1	2	2	2	-	-	-	2	1	-	1	3	3	2
	2	2	2	1	2	2	-	-	-	2	1	-	1	2	2	2
	3	2	2	1	2	2	-	-	-	2	1	-	1	2	2	2
	4	2	2	2	1	2	-	-	-	2	1	-	1	2	2	2
	5	2	2	3	1	2	-	-	-	2	1	-	1	2	2	2 y t

List of Experiments:

Employability/Skill Development

1) Application of Operational Amplifiers
2) Design and testing of Active LPF & HPF using op-amp
3) Design of Schmitt Trigger using op-amp
4) Design of Astable multivibrator using a) op amp b) IC 555
5) Line and load regulation of three terminal IC Voltage Regulator.

6) Operation of R-2R ladder DAC and flash type ADC
7) Simulation of any 4 Experiments 1, 2, 3, 4 , 5 and 6 using Multisim software
8) Minimization and Realization of a given Function using Basic Gates (AND, OR, NOR, NAND, EXOR).
9) Design and implementation of code converters using logic gates (i) BCD to excess-3 code (ii) Gray to binary
10) Design of binary adder and subtractor
11) Design and implementation of Multiplexer and De-multiplexer using logic gates.
12) Implementation and Testing of RS Latch and Flip-flops – D, JK and T.
13) Design of synchronous counters
14) Design of asynchronous counters

Note: A student has to perform a minimum of 12 experiments.

Text Books:

1. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001
2. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", New Age Science, 2010
3. John F Wakerly, “Digital Design-Principles and practices”, 4th Ed., Pearson, 2008
4. Ramakant A. Gayakwad, "OP - AMP and Linear IC's ", Prentice Hall, 2002.

MICROWAVE & RADAR ENGINEERING	
ECE 321	**Credits : 3**
Instruction : 3 periods & 1 Tutorial/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Nil

Course Outcomes:

By the end of the course, the student will be able to:	
1	Understand and use the microwave components in design of different microwave setup
2	Analyze and design microwave circuits using S- Parameters
3	Understand the principles involved in generating /amplifying microwave signals and different devices there of.
4	Carry out microwave measurements for the designed gadgets.
5	Understand the basic of Radar Engineering that includes range equation radar block diagram and different types of radars

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	-	-	-	1	1	-	-	-	-	1	3	3	1
	2	3	2	1	-	-	-	-	-	-	-	-	2	3	3	3
	3	3	2	-	-	-	1	1	-	-	-	-	1	3	1	3
	4	2	2	3	-	-	1	1	-	-	-	-	2	2	2	2
	5	3	1	1	-	-	-	-	-	-	-	-	2	3	1	2

SYLLABUS

UNIT I **12 periods**

Microwave Components:

Introduction to Microwaves, advantages and applications; Coaxial Line Components; Theory of Guided Waves- Waves in between parallel plates parallel plate, Wave Guide – Derivation of Field Equations, Modes of Propagations, and their parameters, Types of Wave-guides; Excitation methods for different TE modes, Wave impedance in waveguide; Attenuators; Cavity Resonators, Re-entrant Cavities, Wave-meters, Microwave Filters, Detectors.

Employability

UNIT II **12 periods**

Microwave Circuits:

Scattering Matrix and its Properties. Scattering Matrix of E Plane Tee, H plane Tee and Magic Tee, Directional coupler & its types, Ferrite Devices-Scattering Matrix of Circulator, Isolator, Gyrator Applications.

Employability

UNIT III **12 periods**

Microwave Signal Generators and Amplifiers:

Resonant Cavity Devices, Reflex Klystron, Two – Cavity Klystron, Multi – Cavity Klystron, Slow – Wave Devices, TWT, Crossed Field Devices, Magnetrons, Semiconductor Devices, Microwave BJTs, FETs, Tunnel Diodes, Gunn Diode, IMPATT, TRAPATT Diodes, Crystal Diode.

Employability

UNIT IV **12 periods**

Microwave Measurements:

Introduction to Microwave bench setup, Measurement of Frequency, Wavelength, VSWR, Unknown impedance, attenuation. Coupling, Isolation and Directivity measurements of Directional coupler. Microwave power measurement, dielectric constant measurement, .

Employability

UNIT V **12 periods**

Radar Engineering :

Radar Range Equation, Radar Block Diagram and Operation, Prediction of Range, Minimum Detectable Signal, Receiver Noise, Radar Cross-section, Transmitter Power, PRF and Range Ambiguities, Radar Antenna Parameters, System Losses and Propagation Effects. Types of radars- MTI & Pulse Doppler Radar, Tracking Radar –Principles; Synthetic Aperture Radar, Phased Array Radar.

Employability

Text Books:

1. Simon Kingsley and Shaun Quegan, "*Understanding Radar Systems*", SciTech Publishing, 1999.
2. G.S.N. Raju, "*Microwave Engineering*",1st ed., IK International Publishers,
3. G. Sasibhushan Rao, "*Microwave & Radar Engineering*" ,1st ed., Pearson Education,2014.

Reference Books:

1. G.S.N Raju, "*Radar Engineering and Fundamentals of Navigational Aids*", 1st ed. IK International Publishers, 2008
2. M.I. Skolnik, "*Introduction to Radar Systems*", McGraw Hill, 2007.
3. R. R. Collin, "*Foundations for Microwave Engineering*", 2nd ed., McGraw Hill.2015.

DIGITAL SIGNAL PROCESSING	
ECE 322	**Credits : 4**
Instruction : 4 periods & 1 Tutorial/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: ECE 214

Course Outcomes:

By the end of the course, the student will be able to:	
1	Mathematically classify different types of signals and perform basic operations on time and amplitude and Represent DT signals in the Frequency domain using Fourier Analysis and Z-Transforms.
2	Transform a DTS into frequency domain using DFT and FFT and compare these two methods with respect to their computation complexity.
3	Design and realize IIR and FIR digital filters for a arbitrary frequencies and attenuation values .
4	Implement sampling rate conversion using decimation and interpolation applied in digital filter banks.
5	Explain the DSP processors which can be used for practical applications and also acquired knowledge on various applications of Digital Signal Processors in speech processing.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	1	1	2	-	-	-	-	-	-	2	1	1	1
	2	2	2	-	1	2	-	-	-	-	-	-	2	2	3	1
	3	2	3	2	1	2	-	-	-	-	-	-	2	3	3	2
	4	2	1	1	1	2	-	-	-	-	-	-	2	2	3	1
	5	1	1	-	1	1	-	-	-	-	-	-	2	1	2	1

SYLLABUS

UNIT I **12 Periods**

Introduction to Digital Signal Processing & Applications of Z-Transforms : Classification of signal & systems – linear shift invariant systems – stability and causality , time response analysis of discrete time systems, frequency domain representation of discrete time signals and systems.
Z-Transforms: Introduction, The Z – Transforms, Properties of Z-Transform, Inverse Z-transforms, Analysis of Linear Time invariant system using Z-Transforms

UNIT II **12 Periods**

Discrete Fourier Series & Fourier Transforms and FFTs: Discrete Fourier Series, Properties of discrete Fourier series, Discrete Fourier transforms: Properties of DFT, Circular convolution, linear convolution of sequences using DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

Employability

UNIT III **12 Periods**

IIR & FIR Digital Filter Design Techniques: Introduction, Analog low pass filter design, Butterworth and Chebyshev approximations, Frequency transformations, Design of HPF
Design of IIR Digital filters from analog filters, Bilinear Transformations method, Impulse and Step invariance method. Design Examples: Analog-Digital transformations, Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques, Frequency Sampling technique, Comparison of IIR & FIR filters.

UNIT IV **12 Periods**

Multirate Digital Signal Processing: Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion. Digital Filter Banks, sub band coding of speech signals.

Employability

UNIT V **12 Periods**

Introduction to DSP Processors & DSP Applications: Introduction to programmable DSPs - Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs, Multiple Access Memory - Multiport memory - VLSI architecture – Pipelining - Special addressing modes - On-Chip Peripherals - Architecture of TMS 320C5X - Introduction, Bus Structure - Central Arithmetic Logic Unit - Auxiliary Register - Index Register - Block Move Address Register - Parallel Logic Unit - Memory mapped registers - program controller - Some flags in the status registers - On-chip registers, On-chip peripherals.
DSP Applications: Application of DSP in Speech Processing – DSP applications in Bio-Medical Engineering.

Text Books:

1. John G. Proakis, Dimitris G.Manolakis, *Digital Signal Processing, Principles, Algorithms, and Applications:* Pearson Education / PHI, 2007.
2. K Raja Rajeswari, *Digital Signal Processing* I.K. International Publishing House.
3. A.V.Oppenheim and R.W. Schaffer, *Discrete Time Signal Processing*, PHI.
4. B.Venkataramani, M.Bhaskar, *Digital Signal Processors – Architecture, Programming and Applications*,TATA McGraw Hill, 2002.

Reference Books:

1. Alan V. Oppenheim and Ronald W. Schafer, *Digital Signal Processing*, PHI.
2. Sanjit K. Mitra, *Digital Signal Processing "A – Computer Based Approach"*,Tata Mc Graw Hill.
3. C. Britton Rorabaugh, *DSP Primer* Tata McGraw Hill, 2005.
4. Robert J. Schilling, Sandra L. Harris CL *Fundamentals of Digital Signal Processing using Matlab* Engineering;

MICROCONTROLLERS & EMBEDDED SYSTEMS	
ECE 323	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites:
Digital Electronics, Computer Architecture & Organization, Microprocessors and Interfacing

Course Outcomes:

By the end of the course, the student will be able to:	
1.	**Acquire** knowledge of the architecture and operation of Intel 8051 microcontroller and Analyze the hardware features like timers, memory, interrupts and serial communication available in 8051 Microcontroller Family of devices
2.	**Develop** assembly language programs for data transfer, arithmetic, logical, and branching operations using instruction set of 8051 and apply them in control applications
3.	**Develop** applications that will provide solution to real world problems by Interfacing 8051 Microcontroller with various peripherals such as ADC, DAC, keyboard, display, Interrupt and Serial communication modules.
4.	**Evaluate** the Embedded system design flow from the requirements to the deployment level and analyze the hardware/software tradeoffs involved in the design of embedded systems.
5.	**Express** the implementation of ARM and SHARC Processors in terms of architecture, and memory organization. Also evaluate the performance metrics of simple and networked Embedded systems

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	1	-	-	-	-	-	-	-	-	2	1	1	1
	2	2	2	1	-	1	-	-	-	-	-	-	2	1	1	1
	3	2	2	2	2	2	-	-	-	-	-	-	2	1	1	1
	4	2	2	1	-	-	-	-	-	-	-	-	1	1	1	1
	5	2	2	1	-	-	-	-	-	-	-	-	2	1	1	1

SYLLABUS

UNIT I: **12 Periods**

8051 Microcontroller:

Introduction to Microcontrollers, comparing Microprocessors and Microcontrollers, Architecture of 8051 Micro controller, Register organization of 8051, SFRs, Addressing modes of 8051.
Pin configuration of 8051, Input/Output Ports and Circuits, External Memory, Counters/Timers and modes of Timers, Serial data Input/Output, Interrupts.

UNIT II: **12 Periods**

Assembly Language Programming of 8051

Programming the 8051. Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions.

UNIT III: **16 Periods**

Interfacing 8051

Interfacing with Keyboards, Displays, D/A and A/D converters, Multiple Interrupts, Serial Data Communication.

UNIT IV: **10 Periods**

Introduction To Embedded Systems

Embedded systems overview, design challenge, Processor technology, IC technology, Design Technology, Trade-offs.

UNIT V: **12 Periods**

Introduction to advanced architectures

ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus; Internet-Enabled Systems, Design Example-Elevator Controller.

Text Books:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D Mc Kinlay , *The 8051 Microcontroller and Embedded Systems Using Assembly and C*, 2nd Edition, Pearson Education, 2008.
2. Frank Vahid, Tony Givargis, *Embedded System Design*, 2nd Edition, John Wiley.
3. Rajeshwar Singh, Dr.D.K.Singh, *Embedded System Design*, 1st Ed., Dhanpat Rai, 2010

Reference Books:

1. Kenneth. J. Ayala, Dhananjay V. Gadre, *The 8051 Microcontroller & Embedded Systems Using Assembly and C*, 1st edition, Cengage learning, 2010
2. David E. Simon, *An Embedded Software Primer*, Pearson Education
3. Satish Shah, *8051 Microcontrollers: MCS 51 Family and Its Variants*, 1/e, Oxford University Press, 2010
4. B. Kanta Rao, *Embedded Systems*, 1st Ed., PHI, 2011
5. Wayne Wolf, *Computers as Components-principles of Embedded computer system design*, Elsevier

ANALOG IC DESIGN	
ECE 324(a)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Network Analysis and Synthesis, Electronic Circuits Analysis-I, Electronic Circuits Analysis-II

Course Outcomes:

By the end of the course, the student will be able to:
1. Understand the basic MOS device physics and models
2. Analyze and design single stage amplifiers
3. Analyze and design differential amplifiers
4. Analyze and design current sources/sinks/mirrors
5. Analyze and design basic operational amplifiers circuits

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
	1	2	2	1	-	-	-	-	-	-	-	-	2	1	1	1
	2	2	2	1	-	1	-	-	-	-	-	-	2	1	1	1
C	**3**	2	2	2	2	2	-	-	-	-	-	-	2	1	1	1
O	**4**	2	2	1	-	-	-	-	-	-	-	-	1	1	1	1
	5	2	2	1	-	-	-	-	-	-	-	-	2	1	1	1

SYLLABUS

UNIT-I: **12 Periods**

Basic MOS Device Physics:

MOSFET as a switch, MOSFET structure and symbols, Threshold voltage, Derivation of I-V characteristics, second order effects.

UNIT-II: **12 Periods**

Device Modeling:

DC Models, Small signal models, use of device models in circuit analysis, DC MOSFET model, and small signal MOSFET model, High frequency MOSFET Model, Measurement of MOSFET Model parameters.

UN IT-III: **12 Periods**

Single stage amplifiers:

Basic concepts, CS stage with resistive load, CS stage with diode connected load, CS stage with Current-Source load, CS stage with Triode load, CS stage with Source degeneration, Source follower, Common gate stage, Cascode stage

UNIT-IV: **12 Periods**

Differential amplifiers:

Single ended and differential operation, qualitative and quantitative analysis of Basic differential pair, common mode response, differential pair with MOS Loads

Passive and Active current mirrors: Basic current mirrors, Cascode current mirrors, Active current mirrors.

UNIT-V: **12 Periods**

Operational amplifiers:

Performance parameters, one stage op-amps, two stage op-amps, gain boosting, common mode feedback, input range limitations, slew rate, power supply rejection.

Text books:

1. Behzad Razavi , *Design of Analog CMOS Integrated Circuits*, Tata McGraw-Hill, 1st edition, 2002.

2. Randall Geiger, Phillip Allen, Noel Strader, *VLSI Design Techniques for Analog and Digital Circuits*, Tata McGraw-Hill, 1st edition, 2010.

References:

1. Douglas R. Holberg, P. E. Allen Phillip E. Allen, *CMOS Analog Circuit Design*, 2nd edition, 2002

ELECTROMAGNETIC INTERFERENCE / COMPATABILITY	
ECE 324(b)	**Credits : 3**
Instruction : 3 periods & 1 Tutorial/Week	Sectional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Nil

Course Outcomes :

By the end of the course, students will be able to :
1. Understand the concept of EMI / EMC, related to product design & development.
2. Analyze the different EM coupling principles and its impact on performance of electronic system.
3. Ensure that a designed system conforms itself to certain standard through a thorough understanding of various standards in different countries.
4. Have broad knowledge of various EM radiation measurement techniques.
5. Model a given electromagnetic environment/system so as to comply with the standards.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2		1			1						2			3
	2	1	2	1									1	2	3	
	3	3	2	3			2						2	2	3	
	4	3	2	3	1			1	1				1	2		
	5	3	2	3									2	2	3	

SYLLABUS

UNIT I **12 Periods**

Introduction to overview of EMI/EMC/ESD/EMP: EM environment, Historical Notes, Problems of EMI, Frequency Conservation, Assignment & spectrum, practical experiences, Occurrence of EMI, Concepts of EMI/EMC-definitions, Sources of noise, Natural and Nuclear Sources of EMI, Conducted and Radiated Emissions and Susceptibility. Introduction - EMI Testing and Compliance Tests, ESD, EMP.

UNIT II **12 Periods**

Elimination/Reduction Methodologies: Grounding Techniques, Shielding Techniques, Electrical Bonding Techniques, Cabling Techniques, Power Supply Filters, Power Supplies, Connectors and Components/ Accessories.

Employability

UNIT III **12 Periods**

EMC Regulation/ Standards:

Introduction to different commercial and defense Standards like FCC, CISPR/IEC, VDE, IEEE/ ANSI, MIL-STD

UNIT IV **12 Periods**

EMI/EMC Measurement Technologies:

Introduction to various instruments used in the measurements and their characteristics, Radiated Interference Measurements, Conducted Interference Measurements, Pitfalls in EMI

Employability

Measurements, Measurements of pulsed EMI, Introduction of Measurement Environment – OATS, Anechoic Chamber, TEM, GTEM cell. Software in EMI/EMC Measurements, Different EMI Test Instruments and their comparisons.

UNIT V **12 Periods**

EMI/EMC Modeling: Modeling of filter for suppression of EMI in the design, choice of various electronic components, Pulse Interference Immunity, EMC computer modeling and Simulation, Signal Integrity EMC design, Guidelines, Probabilistic

Employability

Employability

Text Book

1. IMPACT, *EMI/EMC for Engineering Colleges*, RSTE ,1997.
2. Kodali, V.P., "*Engineering EMC- Principles, Measurements, Technologies and Computer Models*", 2nd Ed., IEEE Press, NY, 2000.

Reference Books:

1. Paul, R.C, "*Introduction to EMC"*, 2nd Ed., John Wiley & Sons Inc., 2006.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	
ECE 324(c)	**CREDITS: 3**
Instruction: 3 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Nil

Course Outcomes:

At the end of the course, the student will be able to:	
1.	Measure various parameters with accuracy, precision and resolution and understand the operation of PMMC and EMMC with their applications
2.	Understand the principle of operation, working of different electronic instruments
3.	Apply the knowledge of cathode ray oscilloscopes and understand the functioning, specification, applications of signal analyzing instruments
4.	Understand principles of measurement associated with different bridges
5.	Select appropriate passive or active transducers for measurement of physical phenomenon

Mapping of course outcomes with POs and PSO's:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	1	1	1	-	-	-	-	-	-	-	1	2	-	3
	2	1	1	2	2	-	-	-	-	-	-	-	1	2	1	2
	3	1	1	1	3	-	-	-	-	-	-	-	2	1	2	2
	4	2	2	2	3	-	-	-	-	-	-	-	1	1	2	2
	5	1	1	2	2	-	-	-	-	-	-	-	3	1	2	1

SYLLABUS

UNIT-I **[10 periods]**

Basic measurement concepts:

Objectives of engineering measurement, performance characteristics-static and dynamic. Errors in measurement, sources of error, types of errors, statistical analysis, classification of standards, permanent magnet moving coil(PMMC) meter, DC ammeter, DC voltmeter, voltmeter sensitivity, series ohmmeter, shunt ohmmeter, Electrodynamometer, problems

UNIT-II **[15 periods]**

Basic electronic instruments:

Instruments for measuring basic parameters-Amplified DC meter, AC voltmeter using rectifier, true RMS responding voltmeter, electronic multimeter, Q-meter, vector-impedance meter, vector voltmeter, rf and power measurement

Digital instruments: digital voltmeters and its different types-ramp, stair case ramp,integrating, continuous balance, successive approximation, resolution and sensitivity of digital meters, Digital multimeter, digital frequency meter, digital measurement of time, phase meter

UN IT-III **[15 periods]**

Oscilloscopes and signal analysis:

Introduction, ,oscilloscope block diagram cathode ray tube, crt circuits, vertical deflection system, delay line, horizontal deflection system, oscilloscope probes and transducers, Measurement of amplitude, time, frequency and phase (Lissajous method). Principle of sampling oscilloscope, digital storage oscilloscope

Signal analysis-basic wave analyzer, heterodyne wave analyzer, harmonic distortion analyzer, spectrum analyzer

UNIT-IV Bridge measurements: **[10 periods]**

Wheatstone bridge, Kelvin bridge, digital read-out bridges, microprocessor controlled bridge AC bridges: Measurement of inductance-Maxwell's bridge, hay bridge, Anderson Bridge. Measurement of capacitance- Schering Bridge, measurement of frequency-Wien bridge, wagners earth connection

UNIT-V **[10 periods]**

Transducers

Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples, and Thermistors), Velocity, Acceleration, Vibration, pH measurement signal conditioning circuits, data acquisition systems, telemetry systems, IEEE 488 standard bus

Employability

Text Books:

1. A.D.Helfrick and W.D.Cooper, "modern Electronic Instrumentation and Measurement Techniques", PHI, 5th edition, 2002
2. Electrical and Electronic Measurements and Instrumentation by A.K.Sawhney, 2002 edition

Reference Books:

1. H.S.Kalsi,"Electronic instrumentation", second edition, TMH, 2004.
2. Oliver and Cage,"electronic measurements and instrumentation, TMH

TELECOMMUNICATION SWITCHING AND NETWORKS	
ECE 324(d)	**CREDITS: 3**
Instruction: 3 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites:
Digital Electronics, Signals and Systems, Electronic Circuit Analysis.

Course Outcomes:

By the end of the Course, the students will be able to:	
1.	Understand and describe the concepts of multiplexing and switching.
2.	Apply probability related concepts to resolve traffic and network related issues
3.	Analyze and solve problems in traffic engineering
4.	Recognize the significance of ISDN and outline its architecture
5.	Obtain an overview of end to end transmission in data networks

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	2	1										2	3	1	1
	2.	3	3	2	1								1	3	2	2
	3.	3	3	3	1								1	3	3	2
	4.	2		1									2	3		1
	5.	2	1	2									3	2	1	2

SYLLABUS

UNIT-I **10 Periods**

Telecommunication Switching Systems :
Basics of Switching Systems, Principles of Cross Bar Switching. Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Two Stage Networks, Three Stage Networks.

UNIT-II **10 Periods**

Time Division Switching :
Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching, Three Stage Combination Switching.

UNIT-III **20 Periods**

Telephone Networks :
Subscriber Loop Systems, Switching Hierarchy and Routing, Transmission Plan, Signaling Techniques: In Channel Signaling, Common Channel Signaling.
Traffic Engineering : Network Traffic Load And Parameters, Grade Of Service, Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems

Employability

UNIT-IV **10 Periods**

Integrated Services Digital Network (ISDN) :

Motivation For ISDN, Network & Protocol Architecture, Transmission Channels, User Network Interfaces, Numbering, Addressing, ISDN Standards, Broadband ISDN.

Employability

UNIT-V **15 Periods**

Data Networks :

Data transmission in PSTNs, Switching techniques for data transmission, Data communication architecture, Link-to-link layers, End-to-End layers, Local Area Networks, Metropolitan Area Networks, Data Network Standards, Protocol Stacks, Internetworking.

Employability

Text Book:

1. Thyagarajan Viswanath, "*Telecommunication Switching Systems and Networks*" PHI, 2000.

Reference Books:

1. J. Bellamy, "*Digital telephony*", 2nd edition, 2001, John Wiley.
2. B.A. Forouzan, "*Data Communication & Networking*", 3rd Edition, 2004, TMH.
3. J E Flood, "*Telecommunication switching, Traffic and Networks*", 2002, Pearson Education.

DIGITAL COMMUNICATIONS	
ECE 325	**CREDITS: 3**
Instruction: 3 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites:
Digital Electronics, Communication Systems, Electronic Circuit Analysis.

Course Outcomes:

By the end of the Course, the student will be able to:	
1.	Compare and analyze various baseband and bandpass digital modulation techniques
2.	Calculate probability of error for various digital modulation techniques to analyze the performance of DCS in the presence of noise.
3.	Analyze the performance of spread spectrum code acquisition and tracking circuits.
4.	Evaluate the channel capacity and Calculate efficiency of various source encoding techniques.
5.	Implement channel coding techniques and comprehend error correction and detection.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	3	3	2		2*				2*			1			
	2.	3	3							1*			1			
	3.	2	3	1						1*			1			
	4.	3	3	1						1*			1			
	5.	3	3	1						1*			1			

Employability

SYLLABUS

UNIT-I **15 Periods**

Analog to Digital Conversion and transmission:

Analog to digital conversion- Pulse Code Modulation, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, Noise in Pulse-Code and Delta-Modulation Systems; Digital modulation techniques- Binary Amplitude-Shift Keying, Binary Phase-Shift Keying, Differential Phase-Shift Keying, Quadrature Phase-Shift Keying (QPSK), M-ary PSK, Quadrature Amplitude Shift Keying (QASK), Binary Frequency Shift-Keying, M-ary FSK.

Employability

UNIT-II **15 Periods**

Data Reception:

A Base-band Signal Receiver, Probability of Error, The Optimum Filter, White Noise: The Matched Filter, Probability of Error of the Matched Filter, Coherent Reception: Correlation, Phase-Shift Keying, Frequency-Shift Keying, Non-coherent Detection of FSK, Differential PSK, QPSK, Error Probability for QPSK, MSK, Comparison of Modulation Systems.

Employability

Employability

UNIT-III **10 Periods**

Spread Spectrum Modulation: Direct Sequence (DS) Spread Spectrum, Use of Spread Spectrum with Code Division Multiple Access (CDMA), Ranging using DS Spread Spectrum, Frequency Hopping (FH) Spread Spectrum, Generation and Characteristics of PN Sequences, Acquisition (Coarse Synchronization) of a DS Signal, Tracking of a DS Signal.

UNIT-IV **10 Periods**

Information theory and coding: Concept of amount of information and its properties, Entropy and its properties, Information rate, mutual information and its properties; Source coding: Shannon's theorem, Shannon-Fano coding, Huffman coding, channel capacity of a Gaussian noise channel, bandwidth-S/N trade off.

UNIT-V **15 Periods**

Channel Coding: Linear Block Codes-Introduction, Matrix description of Linear block codes, cyclic codes, Error detection and error correction capabilities of linear block codes, Hamming codes; Convolution Codes- encoding of convolution codes, Graphical approach: state, tree and trellis diagram.

Employability

Text Books:

1. H.Taub and D.Schilling, "*Principles of Communication Systems*"- TMH, 2003.
2. P.Ramakrishna rao, "*Digital Communication*" – Mc,Graw Hill editon, 2011.

Reference Books

1. Simon Haykin, "*Digital communications*"- John Wiley, 2005.
2. B. P. Lathi, "*Modern Digital and Analog Communication Systems*," (2nd Edition).
3. K.Sam shanmugam, "*Digital and Analog Communication Systems*" - John Wiley, 2005.

COMMUNICATION SYSTEMS ENGINEERING LABORATORY	
ECE 326	**CREDITS: 2**
Practicals: 3 Periods/Week	Sessional Marks: 50
End Exam : 3 Hours	End Exam Marks: 50

Prerequisites:
Communication Systems, Signals and Systems, Electronic Circuit Analysis.

Course objective:

- To realize practical Modulator and Demodulator circuit.
- To analyse Analog modulated signals in time and frequency domain.
- To design practical filter circuits for communication system.
- To analyse the sampling and multiplexing technique.
- To Design a practical pre-emphasis and de-emphasis circuit.
- To study and measure the characteristics of practical AM Super Heterodyne Radio Receiver.

Course Outcomes:

By the end of the Course, the student will be able to:	
1.	Design and Simulate different Modulation schemes
2.	Design high pass and Low-pass filters used in communication system.
3.	Perform multiplexing on analog signals and Retrieve useful information by observing AM and FM in frequency domain.
4.	Design and Simulate a Practical Pre-emphasis and De-emphasis circuit.
5.	Measure the characteristics of practical AM Super Heterodyne Radio Receiver using Spectrum Analyzer, Cathode Ray Oscilloscope & Digital Multi Meter.

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	3	2	3	2	3				2	1		3	3	2	3
	2.	3	2	3	2	3				2	1		3	3	3	3
	3.	3	3	2	3	3				2	2		3	3	3	2
	4.	3	3	3	3	3				2	1		3	3	2	2
	5.	3	3	3	3	3				1	2		3	3	3	3

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

SYLLABUS

TRAINER KIT BASED EXPERIMENTS

1) Amplitude Modulation & Demodulation
2) Frequency Modulation & Demodulation
3) Balanced Modulator
4) Analog Time Division Multiplexing
5) Base band Sampling
6) Pulse Amplitude Modulation & Demodulation
7) Pulse Time Modulation & Demodulation

Employability

8) SSB-SC-AM Modulation
9) Super Hetero dyne Radio Receiver Parameters
10) Spectral Analyses of AM using Spectrum Analyzer
11) Spectral Analyses of FM using Spectrum Analyzer

SIMULATION BASED EXPERIMENTS(Open source/Matlab/Multisim)

Employability

1) Amplitude Modulation & Demodulation
2) Frequency Modulation & Demodulation
3) Balanced Modulator
4) SSB-SC-AM Modulation
5) Pulse Time Modulation & Demodulatio
6) Pr-emphasis & De-emphasis
7) Passive Filter Design
8) Attenuator
9) Twin T Network
10) Envelope Detector
11) Frequency Mixer/IF Amplifier/Automatic Gain Control

A student has to perform minimum of 10 experiments.

Text Books

1. B. P. Lathi, "*Modern Digital and Analog Communication Systems*," 2nd Edition, Oxford University Press, 2010.
2. Simon Haykins, "*Communication Systems*," Wiley, Fifth edition, 2009.
3. P.Ramakrishna Rao, "*Analog communications*" Tata McGraw Hill Education Private Limited. 2011.

MICROCONTROLLER & EMBEDDED SYSTEMS LABORATORY	
ECE327	**Credits:2**
Instruction: 3 Lab periods	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites:
Microprocessors and Interfacing, Microcontroller & Embedded Systems

Course Objectives:
- To program both 8051 to meet the requirements of the user.
- To interface various peripherals
- To handle interrupts
- To design a microcomputer to meet the requirement of the user

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Program 8051 microcontroller to meet the requirements of the user.
2.	Interface peripherals like switches, LEDs, stepper motor, Traffic lights controller, etc.,
3.	Handle interrupts
4.	Design a microcontroller development board to meet the requirements of the user

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1	2	2	3	-	-	-	2	1	1	1	2	2	2
	2	3	2	2	2	3	-	-	-	2	1	1	1	2	3	2
	3	3	2	2	2	3	-	-	-	2	1	1	1	2	2	2
	4	3	2	3	3	3	-	-	-	2	1	1	1	3	3	3

List of Experiments:
1. Study and familiarization of 8051 Microcontroller trainer kit
2. Assembly Language Program for addition of 8-bit numbers stored in an array
3. Assembly Language Program for Multiplication by successive addition of two 8-bit numbers
4. Assembly Language Program for finding largest no. from a given array of 8-bit numbers
5. Assembly Language program to arrange 8-bit numbers stored in an array in ascending order
6. Stepper motor control by 8051 Microcontroller
7. Interfacing of 8-bit ADC 0809 with 8051 Microcontroller
8. Interfacing of 8-bit DAC 0800 with 8051 Microcontroller and Waveform generation using DAC
9. Implementation of Serial Communication by using 8051 serial ports
10. Assembly Language Program for use of Timer/Counter for various applications
11. Traffic light controller/Real-time clock display
12. Simple test program using ARM 9 mini 2440 kit (Interfacing LED with ARM 9 mini 2440 kit)

Skill development

NOTE:

1. It is compulsory for each student to Design/Create their own Microcontroller Development Board for personal use
2. A student has to perform a minimum of 10 experiments.

Text Books:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D Mc Kinlay , *The 8051 Microcontroller and Embedded Systems Using Assembly and C*, 2nd Edition, Pearson Education, 2008.
2. Frank Vahid, Tony Givargis, *Embedded System Design*, 2nd Edition, John Wiley.
3. Rajeshwar Singh, Dr.D.K.Singh, *Embedded System Design*, 1st Ed., Dhanpat Rai, 2010

ENGINEERING ECONOMICS AND MANAGEMENT

ECE 411 **Credits:3**

Instruction: 3 Periods & 1 Tut/week Sessional Marks:40

End Exam: 3 Hours End Exam Marks:60

Prerequisites: Nil

Course Outcomes:

At the end of the course, students will be able to

1. Understand the concepts of Economics.
2. Gain basic understanding of management and manage organizations effectively and to relate the concepts of management with industrial organizations and manage organizations efficiently
3. Have the basic knowledge of production management and make decisions proficiently
4. Understand the basic concepts of accounting, finance and marketing management.

CO-PO –PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	2	3	-	2	1
CO2	-	-	-	-	-	-	-	2	3	-	2	1
CO3	-	-	-	-	-	-	-	2	3	-	2	1
CO4	-	-	-	-	-	-	-	2	3	-	2	1

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Fundamentals of Economics: Wealth, Welfare and Scarce Definitions of Economics; Micro and Macro Economics; Demand- Law of Demand, Elasticity of Demand, Types of Elasticity and Factors determining price elasticity of Demand: Utility- Law of Diminishing Marginal Utility, its limitations and exceptions.

UNIT II 10 Periods

Forms of Business Organizations: Features, merits and demerits of Sole Proprietorship, Partnership and Joint Stock Company- Public Enterprises and their types.

UNIT III 20 Periods

UNIT IV 10 Periods

Financial Management: Types of Capital: Fixed and Working Capital and Methods of Raining Finance; Final Accounts- Trading Account, Statement of Profit and Loss and Balance Sheet (simple problems)

UNIT V 10 Periods

Marketing Management and Entrepreneurship: Marketing Management: Functions of marketing and Distribution Channels. **Entrepreneurship**:Definition, Characteristics and Functions of an Entrepreneur

TEXT BOOKS:

1. A.R. AryaSri, Managerial Economics and Financial Analysis, TMH Publications, new Delhi, 2014**(UNIT–I,II,IV &V)**
2. S.C. Sharma and Banga T. R., Industrial Organization & Engineering Economics,khanna Publications, Delhi-6, 2006**(UNIT– III &IV)**
3. S.N.Maheswari, SK Maheswari, Financial Accounting Fifth Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012 **(UNIT-V)**

COMPUTER NETWORK ENGINEERING

ECE 412 **Credits:3**
Instruction: 3 Periods & 1 Tut/week Sessional Marks:40
End Exam: 3 Hours End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To study the foundational principles, architectures, and techniques employed in computer networks.
- Understand the working of Intranet, LAN, WAN, MAN setups, different topologies.
- Allow the student to gain expertise in some specific areas of networking such as thedesign and maintenance of individual networks.
- To be familiar with different protocols and services such as UDP, TCP and QoS
- To study the Internet and its protocol stack. Architecture, protocol, application-examples will include email, web and media-streaming.

Course Outcomes:

At the end of the course, students will be able to

1. **Apply** the concepts of Computer Networks and Networks Models for Data Communication.
2. **Analyze** networking architecture and infrastructure for wired and wireless link
3. **Design**, calculate, and apply subnet masks and routing addresses to fulfill networking requirements
4. **Analyze** issues of routing and congestion mechanism for independent and internetworking networks for wired and wireless link.
5. **Analyze** internal workings of the Internet and of a number of common Internet applications and protocols (DNS, SMTP, FTP, HTTP, WWW, Security and Cryptography).

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					2								2	2	
CO2		2											1	2	
CO3		2	3	3									2	2	
CO4	1	2											2	2	
CO5		2	3	3									2	2	

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Data Communications: Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences

UNIT II 10 Periods

Data Link Layer: Error – detection and correction – Parity – LRC – CRC – Hamming code – Low Control and Error control - Stop and Wait – go back-N ARQ – Selective Repeat ARQ- Sliding window – HDLC. - LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 – FDDI - SONET – Bridges.

UNIT III 10 Periods

Network Layer: Internetworks – Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

UNIT IV 10 Periods

Transport Layer: Duties of transport layer – Multiplexing – De-multiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

UNIT V 10 Periods

Application Layer: Domain Name Space (DNS) – SMTP – FTP – HTTP - WWW – Security – Cryptography.

TEXT BOOKS:

1. William Stallings, "Data and Computer Communication", Sixth Edition, Pearson Education, New Delhi, 2000. **[UNIT- I,II &III]**
2. Andrew S. Tanenbaum, "Computer Networks", Fourth Edition PHI Learning, New Delhi, 2003.**[UNIT- IV &V]**

REFERENCE BOOKS:

1. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw- Hill Publishing Co. Pvt., Ltd., New Delhi, 2006.
2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education, New Delhi, 2003.

ADVANCED DIGITAL SIGNAL PROCESSING

ECE 414(a) **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Signals and Systems (ECE 214), Digital Signal Processing (ECE 322)

Course Objectives:

- To bring out the concepts related to multi rate signal processing
- To emphasize the importance of true estimation of power spectral density
- To introduce the design of linear and adaptive systems for filtering and linear prediction.

Course Outcomes:

At the end of the course, students will be able to

1.	Understand decimation and interpolation of discrete-time signals.
2.	Design a digital system with different sampling rates.
3.	Describe the properties of various linear filters.
4.	Apply various adaptive algorithms for different applications.
5.	Analyze the parametric and non parametric methods of power spectrum estimation.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	3	-	-	-	-	-	-	-	-	1	2	-	-
CO2	2	3	3	-	-	-	-	-	-	-	-	2	2	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	1	2	-	-
CO4	2	2	3	-	-	-	-	-	-	-	-	1	2	-	-
CO5	1	3	3	-	-	-	-	-	-	-	-	2	2	-	-

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Multi Rate Digital Signal Processing

Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion **Applications of Multi Rate Signal Processing:** Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Sub-band Coding of Speech Signals.

UNIT II10Periods

Linear Prediction And Optimum Linear Filters: Innovations Representation of a Stationary Random Process, Forward and Backward linear prediction, Solution of the Normal Equations,TheGoertzel algorithm, the chirp – z transform algorithm, the Schur algorithm

UNIT III10Periods

Adaptive filters: Applications- Adaptive noise cancelling, adaptive channel equalization, echo cancellation in data transmission over telephone channels. LMS algorithm, properties of LMS algorithm, RLS algorithm, fast RLS algorithms and properties of the RLS algorithms.

Employability

Employability

UNIT IV 10Periods

Non-Parametric Methods of Power Spectral Estimation: Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman-Tukey methods

UNIT V 10 Periods

Parametric Methods of Power Spectrum Estimation& DSP Processors: Autocorrelation & Its Properties, Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation.

Employability

TEXT BOOKS:

1. S. M .Kay, Modern Spectral Estimation: Theory & Application, PHI, 1988. (**UNIT- I, II, III, IV, V)**
2. J.G.Proakis& D. G. Manolakis, Digital Signal Processing: Principles, Algorithms &Applications 4th Ed., PHI.

REFERENCE BOOKS:

1. Theory and applications of digital signal processing by Lawrence R. Rabiner and Bernard Gold, PHI.
2. Digital Signal Processing, A Computer – Based approach, by Sanjit K. Mitra, Tata McGraw-Hill, 1998
3. P.P.Vaidyanathan, Multi Rate Systems and Filter Banks , Pearson Education.

RADAR SIGNAL PROCESSING

ECE 414(b) **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Antennas and wave propagation (ECE 316), Microwave and radar engineering (ECE 321)

Course Objectives:

- Study the principles of radar signalling,
- Mathematically represent radar waveforms and frequency modulated pulse compression,
- Study the basic principle of synthetic aperture radar.

Course Outcomes:

At the end of the course, students will be able to

1.	Describe the principles of CW and FM radar
2.	Understand moving target indication radar, and analyse the time, frequency and signal processing aspects of pulse Doppler radar
3.	Represent the design aspects of radar waveforms including matched filtering
4.	Understand and analyze pulse burst waveform and frequency modulated pulse compression waveforms
5.	Understand the basic principles of synthetic aperture radar

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	3	-	-	-	-	-	-	-	-	1	2	-	-
CO2	2	3	3	-	-	-	-	-	-	-	-	2	2	-	-
CO3	2	2	3	-	-	-	-	-	-	-	-	1	2	-	-
CO4	2	2	3	-	-	-	-	-	-	-	-	1	2	-	-
CO5	1	3	3	-	-	-	-	-	-	-	-	2	2	-	-

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

CW and FM radar: The Doppler effect, CW radar, frequency modulated CW radar, airborne Doppler navigation, multiple frequency CW radar

UNIT II 10 Periods

MTI and pulse Doppler radar: Introduction, Delay line cancelers, multiple or staggered pulse repetition frequencies, range gated Doppler filters, digital signal processing, other MTI delay lines, example of an MTI radar processor

UNIT III 10 Periods

Waveform matched filter: The matched filter, matched filter for the simple pulse, all-range matched filtering, straddle loss, range resolution of the matched filter. Matched filtering for moving targets.

The ambiguity function: definition and properties of the ambiguity function, ambiguity function of the simple pulse

UNIT IV 10 Periods

The pulse burst waveform: matched filtering for the pulse burst waveform, pulse-by-pulse processing, range ambiguity, Doppler response for the pulse burst waveform, the slow-time spectrum and the periodic ambiguity function

Frequency modulated pulse compression waveforms: linear frequency modulation, the principle of stationary pulse, ambiguity function of the LFM waveform, range-Doppler coupling, stretch processing

UNIT V 10 Periods

Synthetic Aperture Radar: Basic block diagram of a typical SAR radar, introduction, constraint and resolution swath, radar equation for SAR, equipment consideration, optinal processing, digital processing, Doppler-frequency model, range resolution, other aspects of SAR, introduction to inverse SAR

TEXT BOOKS:

1. Merill I. Skolnik, “Introduction to radar systems,” Tata McGraw-Hill, 2007 **(UNITS- I,II &V)**
2. Mark A. Richards, “Fundementals of radar signal processing,” Tata Mc-Graw-Hill Educations, 2005 **(UNITS- III &IV)**

REFERENCE BOOKS:

1. Canner Ozedemir, “Inverse synthetic aperture radar imaging with MATLAB algorithms,” Vol 210., John Wiley & Sons, 2012

DIGITAL IC DESIGN USING HDL

ECE 414(c) **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Digital Electronics, Computer Architecture & Organization, Integrated Circuits and Applications

Course Outcomes:

At the end of the course, students will be able to

1.	Interpret the importance of EDA tools and its flow for VLSI designs
2.	Model logic gates ,half adder, full adder ,various digital blocks by using modern tools with HDL
3.	Construct verilog HDL models for combinational and sequential circuits using gate level, behavioral level and dataflow level
4.	Build CMOS circuits using Verilog switch level programming
5.	Apply design rule checks and timing parameters to digital circuits and model the state machines

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										1		2
CO2	1	2	3		1							1	2		
CO3	2	2	1		1							1	1	2	3
CO4	1	2	2		1							1		1	3
CO5	2	1	3		1							1	2	1	3

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Introduction to Electronic Design Automation: Introduction, FPGA Design flow, ASIC Design flow, architectural design, logic design, Physical design of IC. Simulation, verification and testing. EDA Tools: FPGA Design, ASIC Design.

FPGA Based Front End Design-Implementation, FPGA configuration, User constraints Xilinx 3000 Series FPGA architecture, ALTERA FLEX 10K Series CPLD architecture

UNIT II 10 Periods

Verilog Language Constructs: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, System Tasks, Programming Language Interface (PLI), Module, Simulation and Synthesis Tools, Test Benches. Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks, Exercises

UNIT III 10 Periods

Gate level Modeling and Dataflow Modeling: AND Gate Primitive, Module Structure, Other Gate Primitives, Tri-State Gates, Array of Instances of Primitives, Additional Examples, Design of Flip-flops with Gate Primitives, Delays, Strengths and Contention Resolution, Net Types, Design of Basic Circuits, Exercises.Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators.

UNIT IV 10 Periods

Behavioraland Switch Level Modeling: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Examples, Assignments with Delays, Wait construct, Multiple Always Blocks, Designs at Behavioral Level, Blocking and Non blocking Assignments, The case statement, Simulation Flow. *if*and *if*-else constructs, repeat construct, for loop, , while loop, forever loop, parallel blocks, force-release construct, Event. Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Trireg Nets, Exercises

UNIT V 10 Periods

System Tasks, Functions, UDP and SM Charts: Introduction, Parameters, Path Delays, Module Parameters, System Tasks and Functions. File Based Tasks and Functions, Compiler Directives, Hierarchical Access, General observations, Exercises.

User-Defined Functions, Tasks and Primitives-Introduction, Function, Tasks, User- Defined Primitives (UDP), FSM Design (Moore and Mealy Machines), State Machine Charts, Derivation of SM Charts, Realization of SM Charts, Examples based on SM charts

TEXT BOOKS:

1. T.R. Padmanabhan and B. Bala Tripura Sundari,” Design through Verilog HDL” WSE, IEEE Press, 2004**(UNIT-I,II,III,IV &V)**
2. J. Bhaskar” A Verilog Primier” ,First edition ,BSP, 2003**(UNIT-I,II,III,IV &V)**

REFERENCE BOOKS:

1. Brown and ZvonkoVranesic Stephen” Fundamentals of Logic Design with Verilog ”TMH, 2005.
2. Michael D. Ciletti “Advanced Digital Design with Verilog HDL “,Second edition, PHI, 2005.

DIGITAL IMAGE PROCESSING

ECE 414(d) **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Signal & System (ECE 214), Digital Signal Processing (ECE 322)

Course Outcomes:

By the end of the course, students will be able to

1.	Describe the basic components of digital image processing system and transform techniques (FFT, DCT and Hadamard transform).
2.	Analyze image enhancement in spatial domain using smoothing and sharpening operators.
3.	Analyze image enhancement in frequency domain using High pass and low pass filters.
4.	Describe image restoration using Weiner filtering and image segmentation using thresholding and region growing techniques.
5.	Compare and contrast image compression techniques (Variable length coding, LZW coding, Bit plane coding, Lossless predictive coding, Lossy prediction, transform coding).

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	3	-	-	-	-	-	-	-	-	1	3	-	-
CO2	2	3	3	-	-	-	-	-	-	-	-	2	3	-	-
CO3	2	3	3	-	-	-	-	-	-	-	-	2	3	-	-
CO4	2	2	3	-	-	-	-	-	-	-	-	1	3	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	1	3	-	-

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Digital Image Fundamentals: Fundamental steps in digital image processing, Components of an image processing system, Elements of visual perception, Image sensing and acquisition, Image sampling and quantization, Basic relationship between pixels

Image Transforms: Two-dimensional FFT properties, Discrete cosine transform &Hardmard transform

UNIT II 10 Periods

Image Enhancement (Spatial Domain): Introduction, Basic gray level transformation, Histogram processing, Enhancement using arithmetic/logic operations, Basics of spatial filtering: Smoothing and sharpening spatial filter

UNIT III 10 Periods

Image Enhancement (Frequency Domain): Introduction to Fourier transform and the frequency domain, Smoothing and sharpening frequency domain filters, Homomorphic filtering

UNIT IV 10 Periods

Image Restoration: Introductionto image degradation, Noise model, Restoration in presence of noise only, Inverse filtering, Wiener filtering,

Image Segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding (global and adaptive), Region based segmentation

UNIT V 10 Periods

Image Compression: Redundancy, Fidelity criteria, Image compression models, Error free compression: Variable length coding, LZW coding, Bit plane coding, Lossless predictive coding, Lossy prediction, transform coding, image compression standards

Fundementals of morphological processing - Dilation, Erosion, Opening, Closing

TEXT BOOKS:

1. TRafael C Gonzalez, Richard E Woods, “Digital Image Processing,” PHI, Second edition, 2004. **(UNITS I, II, III, IV, V)**
2. Jayaraman S, Esakkirajan S, Veerakumar T, “Digital Image Processing,” Tata McGraw Hill, 2010 **(UNIT-I)**

REFERENCE BOOKS:

1. Anil Kumar Jain, “Fundamentals of Digital Image Processing,” PHI, 2002.

VLSI DESIGN

ECE 415 **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: DigitalElectronics, ECA-I, ECA-II, IC analysis

Course Outcomes:

By the end of the course, students will be able to

1.	Delineate IC Production process, fabrication processes for NMOS, PMOS, BiCMOS Technologies.
2.	Analyze CMOS electrical properties with circuit concepts.
3.	Draw stick diagrams, layouts for CMOS circuits and compute delays of CMOS circuits using modern tools.
4.	Design and test the CMOS digital Circuits at different levels of abstraction using modern tools.
5.	Apply testing methods on the digital designs for DFT.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	0	0	0	0	0	0	0	0	0	0	0	2	1	2
CO2	3	2	1	0	1	0	0	0	0	0	0	0	2	2	1
CO3	3	3	3	0	1	0	0	0	0	0	0	0	2	1	1
CO4	3	2	3	0	0	0	0	0	0	0	0	1	2	2	1
CO5	3	2	2	0	0	0	1	0	0	0	1	1	2	1	2

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

IC Technology: MOS, PMOS, NMOS, CMOS &BiCMOS technologies- Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation, Integrated Resistors and Capacitors.

UNIT II 10 Periods

CMOS Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Basic circuit concepts:

Sheet Resistance R_S and its concept to MOS, Area Capacitance Units, Calculations - Delays, driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out, Choice of layers

UNIT III 10 Periods

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 micron CMOS Design rules, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

EMPLOYABLE

UNIT IV 10 Periods

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits. Different CMOS logic Circuits-Pseudo, Dynamic, Domino, C^2MOS.

Subsystem Design: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators.

EMPLOYABLE

UNIT V 10 Periods

VLSI Testing: CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System-level Test Techniques, Design for testability, Practical design for test guidelines, Buil-In-Self-Test

EMPLOYABLE

TEXT BOOKS:

1. Douglas A, Pucknell, Kamran Eshraghian,"Basic VLSI Design",3rd Edition,Prentice Hall, l996.**(UNITS I, II, III, IV & V)**
2. Weste and Eshraghian, "Principles of CMOS VLSI Design", Pearson Education, 1999

REFERENCE BOOKS:

1. John .P. Uyemura,"Introduction to VLSI Circuits and Systems",JohnWiley, 2003.
2. Wayne Wolf, "Modern VLSI Design", 3rd Edition, Pearson Education, 1997

VLSI LAB

ECE 416(a) **Credits:2**

Instruction: 3 Practical's /Week Sessional Marks:50

End Exam: 3 Hours End Exam Marks:50

Prerequisites: Digital Electronics, VHDL, Verilog

Course Outcomes:

At the end of the course, students will be able to

1.	Work with XILINX VLSI design tools.
2.	Develop the systems for various signal processing and computing applications
3.	Test and verify the prototypes at system level using XILINX Vivado simulators.
4.	Analyze and Develop the prototypes of Digital systems on Artix 7 FPGA.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	2	2	3	-	-	-	-	-		1	2	2	2
CO2	3	2	2	2	3	-	-	-	-	-		1	2	3	2
CO3	3	2	2	2	3	-	-	-	-	-		1	2	2	2
CO4	3	2	3	3	3	-	-	-	-	-		1	3	3	3

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

CYCLE IDigital Design using HDL

Experiment 1: Static Display

Experiment 2: Frequency Divider EMPLOYABLE

Experiment 3: Traffic Light Controller

Experiment 4: Design of Memories

CYCLE IIFPGA prototyping using Artix 7

Experiment 1: Familiarization with Artix 7 FPGA

Experiment 2: Implementation of Adders on Artix 7 FPGA using Verilog

Experiment 3: Implementation of Multipliers on Artix 7 FPGA using Verilog

Experiment 4: Implementation of Moore and Mealy FSM on Artix 7 FPGA using Verilog

Experiment 5: Implementation of ALU on Artix 7 FPGA

Experiment 6: Implementation of 8 bit MAC on Artix 7 FPGA EMPLOYABLE

TEXT BOOKS:

1. JayaramBhasker, "A Verilog Primer", AT&T, Prentice Hall
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design And Synthesis", SunSoft Press1996

REFERENCE BOOKS:

1. ZainalabedinNavabi, "Verilog Digital System Design", 2^{nd} Edition, McGraw-Hill, 2006

SIGNAL AND IMAGE PROCESSING LAB

ECE 416(b) **Credits:2**

Instruction: 3 Practical's /Week Sessional Marks:50

End Exam: 3 Hours End Exam Marks:50

Prerequisites: Signals and systems, Digital signal Processing, Digital Image Processing

Course Outcomes:

By the end of the course, students will be able to

1.	Compute and analyze signal spectrum of discrete system using DFT/FFT algorithms in MATLAB
2.	Design & implement the digital filter in MATLAB programming environments
3.	Program a DSP chip with a variety of real-time signal processing algorithms
4.	Perform some basic operations on an image and improve the appearance and quality of images using Spatial and frequency domain filtering.
5.	Know how morphological functions change images by applying erosion and dilation operations.
6.	Understand the concept of edge detectors and their operation in noisy images.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1			2	2								2	1	1
CO2	1		2	2	2								2	1	1
CO3	1			2	2								2	1	1
CO4	1		1	2	2								2	1	1
CO5	1			2	2								2	1	1
CO6	1			2	2								2	1	1

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

CYCLE IDigital Signal Processing based Experiments

1. Write a MATLAB program to find

 (i) Circular convolution of the given two sequences

 (ii) Linear convolution using circular convolution.

2. Write a MATLAB program to find the spectrum of the given sequence using FFT.
3. Write a MATLAB program to design Butterworth (i) low pass filter (ii) band pass filter for the given specifications.
4. Write a MATLAB program to design Chebyshev type-I and II (i) high pass filter (ii) band reject filter for the given specifications.
5. Write a MATLAB program to convert given analog filter into digital filter using (i) Impulse invariant method (ii) Bilinear transformation
6. Write a MATLAB program to design a FIR low pass filter using various windows techniques.
7. Write a MATLAB program to plot the frequency response of low pass filter using Kaiser window for different values of β

Employability

Code composer studio

8. Linear and circular convolution using CC Studio

9. IIR Filter design using TMS320C6713 DSP Processor

10. FIR Filter design using TMS320C6713 DSP Processor

Skill Development

CYCLE IIDigital Image Processing based Experiments

1. Write a Program in MATLAB to

a. Obtain Negative image b. Obtain Flip image c. Threshold operation (Thresholding)

d. Contrast stretching (e) Zooming

2. Write a program to

   (a) compute the histogram of an input image

   (b) To improve the appearance using histogram equalization technique.

3. Write a program for following geometric transformation on image

(a) Translation (b) Scaling (c) Rotation (d) Shrinking (e) Zooming

4. Write a MATLAB program to add noise in the image and apply image restoration technique using Wiener filter and median filter

5. Write a program to perform smoothing and sharpening operation of an image using spatial filtering

6. Write programs for image

(a) Apply FFT and IFFT on given image (b) Perform low pass and high pass filtering in frequency domain

7. Write a program in MATLAB for edge detection using different edge detection mask

8.Write programs to implement following morphological operations on images

(a)Erosion (b) Dilation (c)Closing (d)Opening

Employability

Skill Development

VIRTUAL INSTRUMENTATION LAB

ECE 416(c) **Credits:2**
Instruction: 3 Practical's /Week Sessional Marks:50
End Exam: 3 Hours End Exam Marks:50

Prerequisites: Nil

Course Outcomes:

By the end of the course, students will be able to

1.	Develop software programs called virtual instruments that apply user interface, program control, data structures, file input output, hardware interfacing, data analysis and signal processing
2.	Experiment with,analyze and document prototype measurement systems using a computer, plug in DAQ interfaces and bench level instruments.
3.	Build an engineering application in lab view, install and configure data acquisition hardware.
4.	Design DAQ using LABVIEW modules.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2							1			3	2	1	1
CO2	2			1		3		1	2	1		3	2	1	1
CO3	2	2	2		1		2				3	3	2	1	1
CO4	2	1	1			3				1	2	3	2	1	1

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

List of Experiments

Experiment 1:
Introduction To Labview
Installing labview software and other toolkits
Experiment 2:
1. Basic arithmetic operations
2. Boolean operations
3. Sum of 'n' numbers using 'for' loop
Experiment 3:
4. Factorial Of A Give Number Using For Loop
5. Sum Of 'N' Natural Numbers Using While Loop
6. Factorial Of A Give Number Using While Loop
Experiment 4:
7. Sorting even numbers using while loop in an array
8. Array maximum and minimum
Experiment 5:
9. Bundle And Unbundle Cluster
10. Flat And Stacked Sequence
11. Application Using Formula Node
Experiment 6:
12. Median Filter
13. Discrete Cosine Transform
Experiment 7:

14. Convolution Of Two Signals
15. Filter Design Using Windowing Technique

Experiment 8:

16.File Transfer Using Sockets

Experiment 9:

17. Acquiring And Processing Speech Signal
18. Acquiring And Processing Image Signal

Experiment 10:

19. Talking Tom Application
20. Developing A Scientific Calculator

Experiment 11:

21.Digital Modulation Like Psk, Qam
22.Estimation, Ber And Eye Diagram

Experiment 12:

23.Design Of Various Filters Like Wave Shaping, Matched, Equalizer

ANTENNA DESIGN LAB

ECE 416(d) **Credits:2**

Instruction: 3 Practical's /Week Sessional Marks:50

End Exam: 3 Hours End Exam Marks:50

Prerequisites: Nil

Course Outcomes:

At the end of the course, students will be able to

1.	Get familiarized with the simulation software
2.	Design the antenna with given specification using the simulation tools.
3.	Extract the various parameters that indicate the performance of the antenna
4.	Interpret the extracted results and analyse them and prepare a formal laboratory report.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	1	2	1	-	-	-	-	2	-	-		1	2	2
CO2	-	2	1	3	-	-	-	-	2	-	-	2	2	2	2
CO3	-	2	2	1	-	-	-	-	2	3	-	1	1	1	1
CO4	-	3	3	3	-	-	-	-	2		-	3	1	2	2

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Employability

SYLLABUS

List of Experiments

1. Design an edge fed microstrip patch antenna & study its S-parameters
2. Design an inset fed microstrip patch antenna & study its S-parameters
3. Design an microstrip line fed slot coupled patch antenna & study its S- Parameters
4. Design a probe fed microstrip patch antenna & study its S- Parameters
5. Design a coplanar waveguide fed patch antenna & study its S- Parameters
6. Design an edge fed microstrip patch antenna & study its 2-D & 3-D radiation Patterns
7. Design an inset fed microstrip patch antenna & study its 2-D & 3-D radiation Patterns
8. Design an microstrip line fed slot coupled patch antenna & study its 2-D & 3-D radiation Patterns
9. Design a probe fed microstrip patch antenna & study its 2-D & 3-D radiation Patterns
10. Design a coplanar waveguide fed patch antenna & study its 2-D & 3-D radiation Patterns

DIGITAL COMMUNICATIONS LABORATORY

ECE 417 **Credits:2**

Instruction: 3 Practical's /Week Sessional Marks:50

End Exam: 3 Hours End Exam Marks:50

Prerequisites: Communication Systems Engineering**,** Digital Communications, Signals and Systems.

Course Outcomes:

By the end of the course, students will be able to

1.	Implement modulation /demodulation of PCM, DPCM and Delta modulation schemes.
2.	Implement different digital modulation schemes like FSK, PSK, and DPSK.
3.	Design and Construct a source Encoder.
4.	Design and implement Channel Encoding techniques.
5.	Simulate various digital communication techniques like PCM, ASK, Companding techniques etc.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	1	-	-	-	-	-	-	-	-	-	1	1	-
CO2	2	-	3	-	-	-	-	-	-	-	-	-	1	1	-
CO3	2	-	3	-	2	-	-	-	-	-	-	-	1	2	-
CO4	2	-	1	-	3	-	-	-	-	-	-	-	1	2	-
CO5	2	-	1	1	3	-	-	-	-	-	-	-	1	2	-

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

CYCLE I Experiments Based on Hardware

1. Generation and Detection of Pulse Code Modulation for both A.C and D.C signals
2. Generation and Detection of Differential Pulse Code Modulation — Skill Development/ Employability
3. Generation and Detection of Delta Modulation — Skill Development/ Employability
4. Generation and Detection of PSK.
5. Generation and Detection of FSK.
6. Generation and Detection of DPSK.
7. Generation and Detection of QPSK. — Skill Development/ Employability
8. Source Encoder and Decoder
9. Linear Block code-Encoder and Decoder
10. Convolution code-Encoder and Decoder — Skill Development/ Employability

CYCLE IIExperiments Based on Software

1. Simulation of Pulse Code Modulation
2. Simulation of Differential Pulse Code Modulation
3. Simulation of Amplitude Shift Keying
4. Simulation of Phase Shift keying
5. Companding
6. Simulation of Time Division Multiplexing

Skill Development/ Employability

Note:A student has to perform minimum of 10 experiments.

CELLULAR AND MOBILE COMMUNICATIONS

ECE 421 **Credits:3**

Instruction : 3 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Communication Systems Engineering**,** Digital Communications

Course Outcomes:

By the end of the course, students will be able to

Solve problems related to	
1.	Principle of operation of cellular mobile systems and their interferences.
2.	Mobile radio propagation & mobile multipath channels.
3.	Handoff, dropped calls and Frequency management and channel assignment strategies.
Analyze and design	
4.	forward and reverse channels of various Multiple access techniques in wireless communications
5.	The changes in implementation of receiver circuitry with the integration of mobile satellites.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	2*						1*				2		
CO2	2	2	2*						1*				2	2	
CO3	3	1							1*				2		
CO4	2	2							1*				2		
CO5	2	1							1*				1		

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Introduction to Cellular Systems: Basic Cellular Systems, Uniqueness of mobile radio environment, Concept of Frequency reuse Channels, Cochannel interference Reduction factor, Desired C/I from a normal case in an Omnidirectional Antenna system, Non Co-channel interference, Cell splitting.

UNIT II 10 Periods

Mobile Radio Propagation: Large scale path loss - Reflection, Diffraction, Scattering, Outdoor and Indoor Propagation models, **Mobile Radio Propagation: small scale fadingand multi path** - small scale Multi path measurements, parameters of mobile multi path channels, Types of small scale fading.

UNIT III 10 Periods

Frequency Management and Channel Assignment: Frequency management, Fixed Channels assignment, Non Fixed Channel assignment, Traffic and Channel Assignment. **Hand Off, Dropped Calls:** Why Hand-Off, Types of Hand-Off and their characteristics, dropped call rates and their evaluation.

UNIT IV 10 Periods

Multiple access techniques for wireless communications:- FDMA, TDMA, Spread spectrum techniques, SDMA, Packet Radio, CSMA , Capacity of cellular CDMA with multiple cells and capacity of SDMA, Details of forward and reverse CDMA channels

UNIT V 10 Periods

Personal access communication systems, personal Mobile satellite communications, Integrating GEO, LEO, MEO satellite and terrestrial mobile systems, Rake receiver and Advanced Rake receiver.

***Note-** Additional topics that can be introduced during the course but are out of the prescribed syllabus – **Performance of Fading channels**

TEXT BOOKS:

1. William C.Y.Lee, Wireless & Cellular Telecommunications, Third Edition,McGraw Hill, International Edition. **[UNIT- I ,II,III]**
2. Theodore S.Rappaport, Wireless communications Principles and Practice, Second Editions, Pearson Publications. **[UNIT- IV ,V]**

REFERENCE BOOKS:

1. GottapuSasibhushanaRao, Mobile Cellular Communication, PEARSON International, 2012.
2. Wayne Tomasi, Electronic Communication system, Pearson.

PHASED ARRAY SYSTEMS

ECE 422(a) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Antenna and Wave Propagation

Course Outcomes:

At the end of the course, students will be able to

1.	Apply the knowledge the engineering and science in understanding and differentiating various system requirements with phased arrays for radar and communication system.
2.	Analyze linear/planar array antennas with required side lobes, beam width, bandwidth etc., and determine their directivity & study various scanning techniques.
3.	Identify, formulate and analyze different antennas to form an array for a given application
4.	Formulate the array patterns using various synthesis techniques
5.	Apply different feeding mechanisms for resonant and travelling wave arrays & measure different parameters of the array

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	1	2	1
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	3	1
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	2	-	-	-	-	-	-	-	-	-	1	1	1
CO5	2	2	1	-	-	-	-	-	-	-	-	-	1	1	1

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Phased Arrays in Radar and Communication Systems: System requirements for radar and communication antennas - Directive properties of Arrays, Array noise characterization, receiving antenna in polarized plane wave field, system considerations, Monopole beam splitting, Array characterization for radar and communication systems - Fundamental results from array theory, Array size determination, Time-delay compensation.

UNIT II 10 Periods

Array Characteristics : Characteristics of linear and planer arrays, Scanning to End-fire, **Scanning Technique:** Introduction Conventional Scanning, Mechanical versus Electronic scanning, Techniques of Electronic scanning, Frequency, Phase and Time Delay scanning principle, Hybrid scanning techniques, Thinned Arrays

Employability

UNIT III 10 Periods

Elements for phased array : Introduction , array elements, polarization characteristics of infinitesimal elements in free space; Electric current antenna elements - dipole and the monopole; Aperture antenna elements – slot elements, waveguide radiators, horn elements, microstrip patch element

Employability

UNIT IV 10 Periods

Phased Array Systems: Beam steering in Phased arrays; Phase Shifters and fundamentals of phase shifters. Parameters effecting the performance of Radar System including parameter management/ error analysis; operational scenario; Multifunctional operations; Transmit - Receive Modules; System Design Methodology, Integration and Testing and Evaluation of Radar Systems ; Introduction on existing PARs . Advances in Phased arrays.

UNIT V 10 Periods

Array Feeds & Measurements: Introduction**,** Series feeds: Resonant Arrays- Impedance and bandwidth, Resonant slot array Travelling Wave Arrays- Frequency Squint and Single Beam condition, Calculation of element conductance, TW slot array Frequency scanning, Phase scanning; Shunt feeds: Corporate feeds, distributed feeds, Introduction - measurement of Low sidelobe patterns & scanning phenomena.

Employability

TEXT BOOKS:

1. Robert J. Mailloux, Phased Array Antenna Handbook, Third Edition, Artech House, 2017 **[UNIT- I ,II &III]**
2. R.C.Hansen, Phased Array Antennas, Second edition, John Wiley & Sons Publications 2009 **[UNIT - IV]**

REFERENCE BOOKS:

1. Peter J. Kahrilas, Electronics Scanning Radar Systems Desing Handbook, Artech House, 1976.
2. A. A. Olinar, G. H. Knittel, Phased Array Radar, Artech House, 1972
3. Skolnik, M.I., Radar Handbook, 3rd edn., The McGraw-Hill Companies, 2008

BIOMEDICAL INSTRUMENTATION

ECE 422(b) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites:

Course Outcomes:

At the end of the course, students will be able to

1.	Understand various methods of acquiring bio signals.
2.	Understand and analyze different biomedical electrodes and sensors used for clinical observation.
3.	Analyze ECG and EEG signal with characteristic feature points.
4.	Measure heart rate, blood pressure and respiration rate. And also understand various sources of blood flow meters.
5.	Understand bio-telemetry & instrumentation used for Clinical Laboratory.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1		2								1	2		
CO2	2	1		2								1	2		
CO3	2	2		2								1	2		
CO4	2	1		2								1	2		
CO5	1	2		1								1	2		

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Introduction to Biomedical Instrumentation: Sources of Biomedical Signals, Basic Medical Instrumentation System, Intelligent Medical Instrumentation Systems, PC Based Medical Instrumentation Systems, General Constraints & Regulations of Medical Devices

UNIT-II 10 Periods

Electrodes, Sensors, and Transducers: Transduction – Electrodes for biophysicalsensing – types of electrodes: surface, needle, micro – inductive, capacitive and temperature transducers

UNIT-III 10 Periods

Measurement of Biological, Physiological parameters: Measurement of bloodpressure, blood volume, respiration rate, temperature, ECG, EEG, EMG andPCG, Safety measures implemented in Biomedical Instrumentation

UNIT-IV

Patient Monitoring Systems and ICU assisting devices: Intensive cardiac careunits and Central monitoring systems, Patient monitoring through biotelemetry.

Pacemakers, Defibrillators, Ventilators and Respirators

UNIT-V

Bio telemetry and Instrumentation for the clinical laboratory: Introduction to biotelemetry, physiological parameters adaptable to biotelemetry, the components of biotelemetry system, implantable units, applications of telemetry in patient care.

TEXT BOOKS:

1. Leslie Cromwell, Fred J Weibell and Erich A Pfeiffer, “Biomedical Instrumentation and Measurements”, 2nd Edition, Pearson, 2003**(UNIT-I,II,&III)**
2. Khandpur R.S, “Hand Book of Biomedical Instrumentation”, Tata McGraw Hill publication, New Delhi 2nd edition 2003.(**UNITS - IV &V)**

REFERENCE BOOKS:

1. Joseph J. Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, 4th Edition, Pearson Education, 2001.
2. John Enderle, Susan Blanchard, Joseph Bronzino, “Introduction To Biomedical Engineering”, 2nd Edition.
3. Geddes L.A., and L.E. Baker, Principles of applied Biomedical Instrumentation, 3rd Ed., Wiley, 1989

OPTICAL COMMUNICATIONS

ECE 422(c) **Credits:4**
Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40
End Exam : 3 Hours End Exam Marks:60

Prerequisites: Basic of Optics, Electromagentic Theory, Communication systems, and Computer networks

Course Outcomes:

At the end of the course, students will be able to

1.	Illustrate the structure and fabrication methods of Optical fibers
2.	Analyze the channel impairments: losses and dispersion
3.	Analyze the Optical sources (LED and LASER) and detectors(PIN and Avalanche Photo diode).
4.	Apply design considerations to analog and digital fiber optic systems
5.	Analyze the components of fiber optic networks: Couplers, multiplexers, switches and filters.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	2	1	1	1	-	-	-	-	-	-	1	2	2	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	-	-	-	-	-	-	-	-	-	1	-	2	-
CO5	1	1	-	-	-	-	-	-	-	-	-	1	-	-	2

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Introduction To Optical Communications:Unguided optical communications – Li-fi - Evolution of fiber optic communications - Basic elements of an optical fiber communication link – Structure of optical fiber waveguide – Total internal reflection - Step-index and graded index fibers - Fiber materials – fiber fabrication – optical fiber cable

EMPLOYABILITY

UNIT II 10 Periods

Signal Degradation In Optical Fibers: Modal analysis - single mode and multi modefibers - Signal attenuation in optical fibers - Dispersion effects in optical fibers - Dispersion Shifted, flattening and Compensating Fibers

EMPLOYABILITY

UNIT III 10 Periods

Optical Sources, Detectors and Amplifiers: Semiconductor Laser diode - LED - Source to Fiber Power launching and coupling - PIN and Avalanche photodiodes - Noise in detection process – Erbium Doped Fiber Amplifiers

UNIT IV 9 Periods

Design Considerations Of Fiber Optic Systems: Optical Tx/Rx Circuits - Power Budget and Rise time Budget of point-to-point digital links

EMPLOYABILITY

UNIT V 12 Periods

Overview Of Optical Networks: Coupler – Multiplexer – Fiber grating filters - TDM, Broadband and dense WDM in fiber optic communications -- SONET / SDH - introduction to FTTH – Optical switching - Broadcast and select WDM Networks –Wavelength Routed Networks

EMPLOYABILITY

TEXT BOOKS:

1. Gerd Keiser, Optical Fiber Communications, 5th Ed., Tata McGraw Hill, 2017 **(UNITS I –V)**
2. DjafarMynbaev and Lowell Scheiner, Fiber-Optic Communications Technology, Pearson education, 2001**(UNITS I, II, III &V)**

REFERENCES:

1. John Senior, Optical Fiber Communications – Principles and practice, 3rd Ed. Pearson, 2008
2. John Powers, An introduction to fiber optic systems, 2nd Ed., McGraw Hill, 1999
3. Rajiv Ramaswami, Kumar Sivarajan and Galen Sasaki, Optical Networks: A Practical Perspective, Morgan Kaufmann, 3rd ed., 2009

EMBEDDED AND REAL – TIME SYSTEMS

ECE 422(d)	**Credits:4**
Instruction : 4 periods & 1 Tutorial/Week	Sessional Marks:40
End Exam : 3 Hours	End Exam Marks:60

Prerequisites: Digital Electronics, Computer Architecture & Organization, Microprocessors, Micro-controllers & Embedded Systems

Course Objectives:

- To develop an understanding of the various concepts behind the Architecture of Embedded Systems
- To learn the issues, Structure & Performance Measures of a Real Time System
- To develop an understanding of the concepts behind the Embedded/Real-Time operating Systems
- To familiarize with the concepts of RTOS
- To familiarize with the Embedded System development tools, languages and models

Course Outcomes:

At the end of the course, students will be able to

1.	Acquire knowledge of embedded systems architecture with respect to both hardware and software
2.	Acquire knowledge of real time systems
3.	Familiarize with the concepts of Embedded/Real-Time operating Systems
4.	Familiarize with various operating Systems
5.	Familiarize with the basics of embedded system development

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1		1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	1		1	-	-	-	-	-	-	-	-	-	-	-	2
CO3			-	-	-	-	-	-	-	-	-	-	-	-	2
CO4			-	-	-	-	-	-	-	-	-	-	-	-	2
CO5			-	-	-	-	-	-	-	-	-	-	-	-	2

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Architectures of Embedded Systems: Classification of Embedded Systems, Skills required for an Embedded System Designer, Hardware architecture: Processor, RTC, Communication buses, power supply, sensors, actuators, Watchdog timer, Embedded S/W Architectures: Round-Robin, Round-Robin with Interrupts, Function-Queue Scheduling, Real-Time Operating System; Architecture of an application.

UNIT II 08 Periods

Real Time Systems: Introduction: A car-and – driver example, Issues in Real Time Computing, Structure of a Real Time System, Task classes, Performance Measures for Real time Systems, Estimating program run-Times.

UNIT III 12 Periods

Embedded/Real-Time Operating System Concepts: Architecture of Kernel, Tasks and Tasks scheduler. ISR, Semaphores, Mutex, Mailboxes, Message Queues, Event Registers, Pipes, Signals, Timers, Memory management, Priority inversion problem

UNIT IV 10 Periods

Overview of Embedded/Real-Time Operating Systems: Application Software, Communication Software, Off-the-Shelf operating Systems, Embedded Operating Systems, Real-Time Operating Systems, Hand-held Operating Systems

Operating system Concepts:

Architecture, Different subsystems, The Scheduler, Objects, Services

UNIT V 08 Periods

Basics of Embedded System development: Co-design issues, Languages, tools, design issues and embedded system models for design.

TEXT BOOKS:

1. Dr. K.V.K.K. Prasad, Embedded/Real-Time Systems: Concepts, Design & Programming, New edition 2011, Dreamtech Press**(UNIT-I,III &IV)**
2. C.M. Krishna, Kang G. Shin, Real-Time Systems, Indian Edition 1997, Tata McGraw Hill**(UNIT-II &V)**

REFERENCE BOOKS:

1. Qing Li, Caroline Yao, Real-Time Concepts for Embedded Systems, First edition 2014, Elsevier, CMP Books.

SATELLITE COMMUNICATIONS & GPS

ECE 423(a) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Communication Systems Engineering**,** Digital Communications

Course Outcomes:

At the end of the course, students will be able to

1.	Describe and justify communication satellite subsystem with specifications.
2.	Analyze C/N ratio for satellite single link budgets in air and rain.
3.	Classify and analyze multiple access techniques required for satellite communication.
4.	Determine GPS receiver position using one & more satellite in 2D & 3D.
5.	Describe various GPS system segments, GPS signals & signal structures using PRN codes.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	1*					1*	1*			2		
CO2	3	2	2	1*					1*	1*			2		
CO3	3	2	2	1*					1*	1*			2		
CO4	3	2	1	1*					1*	1*			2		
CO5	3	3	1	2*					1*	1*			2		

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Introduction : Types of satellites- Satellite orbit- satellite constellation- orbital mechanics- equation of orbit-orbital elements- look angle determination- limits of visibility- eclipse- sub satellite point- sun transit outage- space craft technology structural, primary power, attitude and orbit control, thermal, propulsion, telemetry, tracking and command, communication subsystems- launching procedures and launch vehicles

UNIT II 10 Periods

Propagation Impairments And Space Link: Introduction, atmospheric loss, ionospheric effects, rain attenuation, other impairments.

Space link: Introduction, EIRP, transmission losses, link power budget, system noise, CNR, uplink, down link, effects of rain, combined CNR

UNIT III 10 Periods

Multiple Access: Frequency division multiple access (FDMA) Intermodulation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples. Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple access (CDMA),Spread spectrum transmission and reception.

UNIT IV 10 Periods

Introduction To Global Navigation Satellite Systems(GNSS): The History of GPS, The Evolution of GPS, Development of NAVSTAR GPS, Block I, Block II satellites, Block IIA, Block IIR and Block II R-M satellites. GPS working principle, Trilateration, Determination of where the satellites are, Determination of how far the satellites are, Determining the receiver position in 2D or XY Plane, Determining the receiver position in 3D or X-Y-Z Plane

UNIT V 10 Periods

GPS Satellite Constellation And Signals: GPS system segments, Space segment, Control segment, User segment, GPS Signals, Pseudorandom noise (PRN) code, C/A code , P code Navigation data, Signal structure of GPS.

***Note-** Additional topics that can be introduced during the course but are out of the prescribed syllabus –**The working of a satellite phone, Introduction to IRNSS**

TEXT BOOKS:

1. T. Pratt and C.W. Boastian, “Satellite Communication”, 2 nd edition, John Wiley & Sons, 2002**.(UNIT-I,II,III)**
2. G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010**(UNIT-IV,V)**

REFERENCE BOOKS:

2. D. Roddy, “Satellite Communications”, Prentice Hall, 4 th edition, copyright, 2008.
3. K.N. Raja Rao, “Satellite Communication: Concept and Application”, 2^{nd} edition, PHI, 2013

VLSI SIGNAL PROCESSING

ECE 423(b) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites:VLSI Design, Digital IC Design and Digital signal Processing

Course Outcomes:

By the end of the course, students will be able to

1.	Represent the DSP algorithms and transforms as systems with block, signal flow and data flowdiagrams.
2.	Design pipeline and parallel processed FIR filters.
3.	Perform retiming and minimize the registers and solve the systems of inequalities.
4.	Design systolic architecture using canonical mapping and generalized mapping
5.	Design and analyse parallel and pipeline IIR

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1										2	2	1
CO2	3	3	3										2	2	1
CO3	3	2	2										2	3	1
CO4	3	2	3										2	2	1
CO5	3	2	3										3	2	1

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

Introduction to the VLSI Signal Processing : Typical Signal Processing Algorithms, Overview of VLSI Architectures, Representations of DSP Algorithms.

Pipelining and parallel processing: Introduction, Data Flow Graph Representation, Loop bound and Iteration Bound, Algorithms for computing Iteration bound, Pipelining of FIR filters, Parallel Processing

UNIT II 10 Periods

Retiming: Definitions and Properties, Solving systems of inequalities, Retiming techniques.

Unfolding and Folding: Unfolding Algorithm, Properties of unfolding, Critical Path, Unfolding and Retiming, Folding Transformation, Register Minimization techniques

UNIT III 10 Periods

Systolic Architecture Design

Matrix Operations and 2D Systolic Array Design, Parallel Algorithm Expressions, Canonical Mapping Methodology.

Arithmetic components

Parallel bit circuits: Carry-Look ahead addition, Prefix Computations, Carry-Save Addition, Multiplication.

UNIT IV 10 Periods

Fast Convolution: Introduction, Cook-Toom algorithm, Winogard algorithm, Iterated Convolution and Cyclic convolution.

UNIT V 10 Periods

Programmable Digital Signal Processors

Important Features, DSP Processors for Mobile and Wireless Communications, Processors for Multidimensional Signal Processing.

TEXT BOOKS:

1. K. K. Parhi, “VLSI Digital Signal Processing Systems, Design and Implementation”, John Wiley, 1999**(UNIT-I,II,III,IV &V)**

REFERENCE BOOKS:

1. S.Y.Kung, “VLSI Array Processors”, Prentice-Hall, 1988

WIRELESS SENSOR NETWORKS

ECE 423(c) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Telecommunication Switching & Networks, Computer Network Engineering, Communication Systems Engineering.

Course Objectives:

- To introduce students to the concept of wireless sensor networks (WSNs).
- To familiarize students with sensor network architectures.
- To introduce various MAC protocols for WSNs
- To discuss naming and addressing in WSNs.
- To present the applications of WSNs with a brief emphasis on localization

Course Outcomes:

At the end of the course, students will be able to

1.	Understand the technologies that enable wireless sensor networks
2.	Identify various sensor network scenarios and architectures
3.	Distinguish between various classes of MAC protocols
4.	Understand allocation of addresses and management of names in WSNs
5.	Appreciate the growing demand for WSNs in diverse areas

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1											2		
CO2	2	2	3										2	2	
CO3	2	2	2										2	2	
CO4	2	1											1		
CO5	1	1											1		

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 12 Periods

Introduction to Wireless Sensor Networks: Ambient Intelligence, Types of Applications, Challenges for WSNs, Differences between mobile ad hoc networks and wireless sensor networks, Enabling Technologies for Wireless Sensor Networks.

Single-Node Architecture: Hardware Components, Operating Systems and Execution Environments: Embedded operating systems, Programming paradigms and application programming interfaces

UNIT II 8 Periods

Network Architecture: Sensor Network Scenarios, Optimization goals and figures of merit, Design principles for WSNs - Distributed organization, In-network processing, Adaptive fidelity and accuracy.

Physical Layer and Transceiver Design Considerations - Energy usage profile, Choice of modulation scheme

UNIT III 12 Periods

MAC Protocols for Wireless Sensor Networks: Fundamentals of (wireless) MAC protocols: Requirements and design constraints for wireless MAC protocols, Important classes of MAC protocols, MAC protocols for wireless sensor networks, Low duty cycle protocols – STEM, Contention-based protocols: CSMA protocols, Schedule-based protocols: LEACH, Simulation study of protocols

UNIT IV 8 Periods

Naming and addressing: Fundamentals, Use of addresses and names in sensor networks, Address management tasks, Uniqueness of addresses, Address allocation and assignment, Addressing overhead, Address and name management in wireless sensor networks.

UNIT V 10 Periods

Localization and positioning: Properties of localization and positioning procedures, Possible approaches, Proximity, Trilateration and triangulation, Mathematical basics for the lateration problem, Single-hop localization: Active Badge, Active office, RADAR, Cricket **APPLICATIONS of WSN:** Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications.

***Note-** Additional topics that can be introduced during the course but are out of the prescribed syllabus – **Case study on TinyOS**

TEXT BOOKS:

1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005 **[UNIT- I-V]**
2. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007. **[UNIT- V]**

REFERENCE BOOKS:

1. C. S. Raghavendra, Krishna M. Sivalingam, Wireless Sensor Networks, Springer, 2004.
2. S Anandamurugan, Wireless Sensor Networks, Lakshmi Publications

COGNITIVE RADIO NETWORKS

ECE 423(d) **Credits:4**

Instruction : 4 periods & 1 Tutorial/Week Sessional Marks:40

End Exam : 3 Hours End Exam Marks:60

Prerequisites: Electromagnetic Wave Propagation and Characteristics, Communication System Engineering, Digital Signal Processing.

Course Objectives:

- Understand the systems required by a software-defined radio to function and the trade-offs and limitations encountered in the design of a software-defined radio system.
- To study about requirements, benefits and different models for Software Defined Radio
- To study in detail about Soft ware Defined Radio Architectures for performance optimization
- To get complete knowledge regarding functioning of different blocks and techniques associated with Software Defined Radio

Course Outcomes:

At the end of the course, students will be able to

1.	Illustrate the mathematical modeling and design issues of OFDM and MIMO
2.	Evaluation of Software Defined Radio architecture and its parameters
3.	Develop mathematical model for cognitive radio networks
4.	Analyze spectrum sensing network by using OFDMA and spectrum management by Heterogeneous Wireless Networks
5.	Interpret Regulatory Issues and International Standards

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2											2		
CO2		2	2										1	2	
CO3		2	3											2	
CO4		2	3										2	2	
CO5															

Correlation levels1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I 10 Periods

INTRODUCTION TO WIRELESS COMMUNICATIONS Software Defined Radio Architecture, Digital Signal Processor and SDR Baseband Architecture, Reconfigurable Wireless Communication Systems: Unified Communication Algorithm, Reconfigurable OFDM Implementation, Reconfigurable OFDM and CDMA, Digital Radio Processing: Conventional RF, Digital Radio Processing (DRP) Based System Architecture

UNIT II 10 Periods

SOFTWARE DEFINED RADIO AND ITS ARCHITECTURE Software defined radio architectures, Hardware specifications, Digital aspects of Software defined radio, Current technology limitations, minimum power consumption, ADC performance trends

UNIT III 10 Periods

COGNITIVE RADIO NETWORKS Cognitive Radios and Dynamic Spectrum Access, Analytical Approach and Algorithms for Dynamic Spectrum Access, Fundamental Limits of Cognitive Radios, Mathematical Model and simulation of Networking Cognitive Radios.

UNIT IV 10 Periods

SPECTRUM SENSING Spectrum sensing to detect specific Primary System, Spectrum Sensing for Cognitive Radio OFDMA Systems and Cognitive Multi-Radio Networks

UNIT V 10 Periods

SPECTRUM MANAGEMENT Spectrum Management- Spectrum Sharing, Spectrum Pricing, Mobility Management to Heterogeneous Wireless Networks, Regulatory Issues and International Standards

TEXT BOOKS:

1. Kwang-Cheng Chen and Ramjee Prasad, “Cognitive Radio Networks”, John Wiley & sons, 2009. **(UNIT- I,II,III,IV & V)**
2. EzioBiglieri, Robert Calderbank, "MIMO Wireless Communications" Cambridge University Press 2007

REFERENCE BOOKS:

1. Ahmed Khattab, Dmitri Perkins, MagdyBayoumi, “Cognitive Radio Networks : From Theory to Practice”, Springer, 2013.
2. Walter Tuttlebee, “Software Defined Radio- Baseband Technology for 3G Handsets and Base stations”, John Wiley @ Sons, 2004

MICROWAVE EINGINEERING LABORATORY

ECE 424 — **Credits:2**

Instruction: 3 Practical's /Week — Sessional Marks:50

End Exam: 3 Hours — End Exam Marks:50

Prerequisites:

Course Objectives:

- The main objective of the course is to make the students get the exposure to various microwave sources, microwave passive components and bench setup in this lab. Also, get the opportunity to measure various parameters related to components, and characterize microwave devices with the microwave bench setup.

Course Outcomes:

At the end of the course, students will be able to

1.	Find the bench set up before start of the experiment, identifying the required apparatus and procedure of doing the experiment.
2.	Measure various parameters of the signal, load & characterize various microwave sources using microwave bench setup.
3.	Plot the radiation pattern of horn antenna and other antennas using antenna trainer system.
4.	Design the antenna with given specification using simulation tools.
5.	Measure and record the experimental data, plot it and analyse the results, and prepare a formal laboratory report.

CO-PO –PSO Mapping

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	1	2	1	-	-	-	-	2	-	-		1	2	2
CO2	-	2	1	3	-	-	-	-	2	-	-	2	2	2	2
CO3	-	2	2	1	-	-	-	-	2	3	-	1	1	1	1
CO4	-	3	3	3	-	-	-	-	2		-	3	1	2	2
CO5	-	-	-	3	-	-	-	-	2	3	-		1	2	3

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

List of Experiments

1. Study of microwave components
2. Vi characteristics of the gunn diode
3. Characteristics of reflex klystron
4. Measurement of the frequency and wavelength of a given signal
5. Measurement of the unknown load impedance of a given load
6. Measurement of the vswr of a given load
7. Determine the characteristics of a given directional coupler
8. Determine the attenuation characteristics of a given load
9. Determine the scattering parameters of e-plane tee junction
10. Determine the scattering parameters of h-plane tee junction

Employability

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Employability

Skill Development

Skill Development

11. Determine the scattering parameters of magic tee junction
12. Determining the radiation pattern of the horn antenna

Skill Development

13. Study of antenna trainer systems
14. Determining the radiation pattern of a 3 element yagi- uda antenna with folded dipole
15. Determining the radiation pattern of a 5 element yagi- uda antenna with folded dipole
16. Determining the radiation pattern of a λ/2 phased array antenna

Skill Development

Skill Development

Note: A student has to perform minimum of 10 experiments.

ENGINEEERING MATHEMATICS-III

EEE 211 **Credits: 3**
Instruction: 3 periods & 1 Tut / Week Sessional Marks: 40
End Exam : 3 Hours End Exam Marks : 60

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Outcomes:

At the end of the course student should be able to:

CO1: Understanding the concepts of Gradient, Divergence and Curl and finding scalar potential function of irrrotational vector fields.
CO2: Understanding the concepts of Green's Theorem, Stokes' Theorem and the Divergence Theorem and to evaluate line integrals, surface, integrals and flux integrals.
CO3: Understand some basic techniques for solving linear partial differential equations and how to identify a partial differential equation in order to determine which technique(s) can best be applied to solve it.
CO4: Understand the methods to solve the Laplace, heat, and wave equations.
CO5: To gain good knowledge in the application of Fourier Transforms.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	0	2	0	1	0	1	0	1	1	1	1
CO2	2	2	1	0	2	0	1	0	1	0	2	1	1	1
CO3	3	2	1	0	1	0	1	0	1	0	1	1	1	1
CO4	2	2	1	0	2	0	1	0	1	0	2	1	1	0
CO5	2	2	1	0	1	0	1	0	1	0	2	1	1	1

SYLLABUS

UNIT-I:

VECTOR DIFFERENTIATION (12 Periods)

Differentiation of Vectors – Scalar and Vector point function – Del applied to Scalar point functions - Gradient geometrical interpretations – Directional Derivative - Del applied to vector point function – divergence - Curl – Physical interpretation of Divergence and Curl - Del applied twice to point functions- Del applied to product of point functions.

UNIT-II :

VECTOR INTEGRATION (12 Periods)

Integration of vectors – Line integral – Surface – Green's theorem in the plane – Stokes theorem – Volume integral – Gauss Divergence theorems (all theorems without proofs) – Irrotational fields .

UNIT-III:

PARTIAL DIFFERENTIAL EQUATIONS (12 Periods)

Introduction – Formation of Partial Differential Equations – Solution of Partial Differential Equations by Direct Integration – Linear Equations of the First order – Higher order Linear Equations with Constant Co-efficients – Rules for finding the complementary function - Rules for finding the Particular integral – Non- Homogeneous linear equations with constant coefficients.

UNIT –IV:

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (12 Periods)

Introduction – Method of separation of variables – Vibrations of a stretched string- Wave equation – One dimensional Heat flow - Two dimensional Heat flow – Solution of Laplace's equation.- Laplace's equation in Polar Co-ordinates.

UNIT-V:

FOURIER TRANSFORMS (12 Periods)

Introduction – definition – Fourier integral theorem - Fourier sine and cosine integrals – Complex form of Fourier integrals – Fourier integral representation of a function – Fourier Transforms – Properties of Fourier Transforms – Convolution Theorem – Parseval's identity for Fourier transforms – Fourier Transforms of the Derivatives of functions – Application of Transforms to Boundary value problems – Heat conduction – Vibrations of a string.

Text Books:

1. Dr. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, New Dehli, 2014.

Reference books:

1. A Text book on Engineering Mathematics by N.P. Bali Etal, Laxmi pub.(p)Ltd , 2001.
2. Advanced Engineering Mathematics by H.K.Dass , S.Chand Publications, 2007.
3. Advanced Engineering Mathematics by Erwin kreyszig, John Wiley Publications, 1999.

ENGINEERING MECHANICS & STRENGTH OF MATERIALS

2016-17/256,2017-18/250,2018-19/264,2019-20/266

EEE 212 **Credits: 3**
Instruction: 3 periods & 1 Tut / Week Sessional Marks: 40
End Exam.: 3 Hours End Exam Marks : 60

Course Objectives:

To make the students to understand the principles of the effect of forces under the static and dynamic conditions and apply them to some practical applications. To make the students to understand the principles of the effect of forces on deformable rigid bodies under various loading conditions, and thus measure various types' stresses such as direct stresses, bending stresses, torsional stresses

Course Outcomes:

Students will be able to:

CO1: Evaluate the forces in concurrent and coplanar force systems, using various principles and also under different conditions of equilibrium. Analyze the forces in various applications and apply the concepts of friction to some basic applications of Electrical engineering.
CO2: Understand and apply principles of parallel force systems to find centroid and moment of inertia of different objects.
CO3: Apply the concepts of kinematics and kinetics to analyze force on particles under rectilinear.
CO4: Distinguish between various mechanical properties like yield strength, ultimate strength etc., of a given material and also to determine various types of direct stresses. Analyze the effect of shear force & bending moment on various beams.
CO5: Determine the bending stresses in different beams of various cross sections and to find torsional stresses in shafts.

Mapping of course outcomes with program outcomes and program specific outcomes :

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	3	0	0	0	3	0	2	0	0	0	0	0
CO2	0	2	0	0	0	0	1	0	3	0	0	0	0	0
CO3	0	2	0	3	0	0	1	0	2	0	0	0	0	0
CO4	0	2	0	3	1	0	2	0	1	0	0	0	0	0
CO5	0	1	0	3	0	0	2	0	0	0	0	0	0	0

SYLLABUS

Part –A : **Engineering Mechanics**

Unit – I **(12 Periods)**

Statics:

Fundamentals of Mechanics: Basic Concepts, Force Systems and Equilibrium, Moment and Couple, Principle of Superposition & Transmissibility, Varignon's theorem, Resultant of force system – Concurrent and non concurrent coplanar forces, Condition of static equilibrium for coplanar force system, concept of free body diagram, applications in solving the problems on static equilibrium of bodies.

Friction Concept of dry friction, limiting friction, angle of friction, Friction problems related to connecting bodies and ladder.

Unit – II **(10 Periods)**

Properties of bodies:

Center of Gravity: Center of Gravity of Plane figures, Composite Sections and shaded areas.

Area Moment of Inertia: Parallel and Perpendicular axis theorem, Moment of Inertia of symmetrical and unsymmetrical sections

Unit – III **(08 Periods)**

Dynamics:

Kinematics – Introduction to kinematics, Equations of motion for uniform and variable motion; Projectiles.

Kinetics – D'Alemberts principle, Work energy method, Impulse momentum methods.

Part – B : **Strength of Materials**

Unit – IV **(15 Periods)**

Simple Stresses and Strains: Stresses and Strains, stress-strain curve, Bars of uniform, varying and tapered cross –sections, Poisons ratio, volumetric strain and relation between moduli of elasticity

Shear Force and Bending Moment: Cantilever, Simply Supported and Overhanging beams subjected to point loads and uniformly distributed loads.

Unit – V **(15 Periods)**

Bending stresses in beams: Theory of pure bending, Flexure formula, Section modulus for cantilever and simply supported beams having symmetrical and unsymmetrical sections

Torsion of Shafts: Torsion equation for circular shaft, polar modulus and related problems.

Text Books:

1. Engineering mechanics by Bhavikatti. New age international.
2. Engineering mechanics by A.K. Tayal.
3. S. Ramamrutham & R, Narayanan, Strength of Materials, Dhanpat Rai publications.
4. R.K. Bansal "A Text Book of Strength of Materials, Lakshmi Publications Pvt. Ltd,New Delhi

References:

1. Engineering Mechanics by S.Timoshenko and D.H. Young McGraw-Hill.
2. Mechanics of Materials by E P Popov
3. Dr Sadhu Singh, Strength of Materilas.

2016-17/257,2017-18/251,2018-19/265,2019-20/267

ELECTROMAGNETICS

EEE 213 **Credits: 3**

Instruction: 3 periods & 1 Tut / Week Sessional Marks: 40

End Exam : 3 Hours End Exam Marks : 60

Course Objectives:

At the end of the course student should understand

- Static Electric Fields
- Static Magnetic Fields
- Time Varying fields and coloration of electric and magnetic field.
- Wave propagation & Poynting theorem

Course Outcomes:

Upon the completion of this course, students will be able to

CO1: Understand the static electric fields

CO2: Understand the properties of conductors and dielectrics

CO3: Understand the static magnetic fields

CO4: Understand the Faraday's laws (time varying fields)

CO5: Understand the wave propagation & Poynting theorem

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	0	1	0	0	1	0	1	0	0	1	1	1
CO2	3	2	1	1	0	0	1	0	1	0	0	1	1	1
CO3	3	2	0	1	0	0	1	0	1	0	0	1	1	1
CO4	3	2	0	1	0	0	1	0	1	0	0	1	1	1
CO5	3	1	0	1	0	0	1	0	1	0	0	1	1	1

SYLLABUS

UNIT-I: **(14 periods)**

Co-ordinate systems: Cartesian, Cylindrical and Spherical coordinate systems, Coordinate transformations, **Static electric fields:** various types of charge distribution, The experimental law of Coulomb, Electric field intensity, Electric field intensity due to infinite line, infinite surface charge distributions. Electric flux density, Gauss law and its applications, point form Gauss law.

Skill Development

UNIT-II: **(14 periods)**

Absolute Electric potential, Potential difference, potential gradient, Calculation of potential differences for point charge, infinite line charge distribution. Electric dipole, Energy density in electrostatic field, Current, current density, continuity equation of current, point form of ohm's law, properties of conductors and boundary conditions, properties of dielectrics and boundary conditions, capacitance, parallel plate capacitor, composite parallel plate capacitor, energy stored in capacitor.

Skill Development

UNIT-III: **(12 periods)**

Poisson's and Laplace's equations, one-dimensional solutions of Laplace's equations, applications of Poisson's and Laplace's equations, method of images, **Static magnetic fields:** types of current distributions (line current, surface current and volume current), Biot-Savart law, magnetic field intensity due to straight conductor, circular loop, infinite sheet of current**.** Ampere's circuital law and applications, point form of Ampere's circuital law, magnetic flux and magnetic flux density, scalar and vector magnetic potentials.

Skill Development

UNIT-IV: **(10 periods)**

Integral and differential forms of Maxwell's equations for static fields, Lorentz force equation, Force on a moving charge, Force on a differential current element, Force between current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetic boundary conditions, energy stored in magnetic field, Inductance and mutual inductance, Inductance evaluation for solenoid, toroid, coaxial cables

Skill Development

UNIT-V: **(10 periods)**

Time varying fields: Faraday's law of Electromagnetic induction, statically induced e.m.f, dynamically induced e.m.f, modified ampere's circuital law for time varying fields, displacement current, integral form and differential forms of Maxwell's equations for time varying fields, wave equation in free space, wave equation for harmonically varying fields, uniform plane wave equation, intrinsic impedance, Poynting theorem and power considerations.

EMPLOYABILITY

TEXT BOOKS:

1. William H Hayt and Jr John A Buck, "Engineering Electromagnetics" , Tata Mc GrawHill Publishing Company Ltd, New Delhi, 2008
2. Sadiku MH, "Principles of Electromagnetics", Oxford University Press Inc, New Delhi, 2009
3. Narayana Rao N., "Elements of Engineering Electromagnetics" Fourth Edition Prentice Hall of India, New Delhi 1998.
4. Vector fields by Boast, Mc Graw Hill.

REFERENCES:

1. David K Cheng, “Field and Wave Electromagnetics”, Pearson Education Inc, Delhi, 2004
2. John D Kraus and Daniel A Fleisch, “Electromagnetics with Applications”, Mc Graw Hill Book Co, 2005.
3. Karl E Longman and Sava V Savov, “Fundamentals of Electromagnetics”, Prentice Hall of India, New Delhi,2006.
4. K.A. Gangadhar “Electromagnetics Field Theory” Khanna Publishers, Delhi, 2013.

NETWORK THEORY

EEE 214 **Credits: 3**
Instruction: 3 periods & 1 Tut / Week Sessional Marks: 40
End Exam.: 3 Hours End Exam Marks : 60

Course Objectives:

The main objectives of the course are:

- Analysis of D.C and A.C. circuits using basic network theorems and topologies.
- Analysis of transients in RLC and coupled circuits.
- Understanding the concept of resonance.
- Analysis of 3-phase circuits.

Contribution to Outcomes:

At the end of the course the student will be able to:

CO1: Apply basic network theorems and analyze both D.C and A.C. circuits.
CO2: Determine various parameters of two port networks.
CO3: Find natural and forced response of RL, RC & RLC circuits.
CO4: Analyze circuits under resonant condition.
CO5: Synthesize the networks and apply network topologies.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	3	3	0	0	0	1	0	0	1	1	1
CO2	3	3	3	3	3	0	0	0	1	0	0	1	1	1
CO3	3	3	1	1	3	0	0	0	1	0	0	1	1	1
CO4	3	3	3	3	3	0	0	0	1	0	0	1	1	1
CO5	3	3	2	1	3	0	0	0	1	0	0	1	1	1

SYLLABUS

UNIT-I: **(15 periods)**

Independent & Dependent Sources, Mesh Analysis, Nodal Analysis, Application of Superposition, Thevenin's, Norton's, Maximum power transfer and Milman's theorems to both D.C and A.C circuits.

Skill Development

UNIT-II: **(11 periods)**

Coupled Circuits: Magnetically coupled circuits, dot convention.

Two-port Networks: Z, Y, H, T Parameters of two port networks, reciprocity theorem.

Skill Development

UNIT-III: **(14 periods)**

DC Transients: Source free RL & RC circuits, Driven RL & RC circuits, Natural and forced response of RL & RC circuits. Source free and driven RLC circuits, Natural and forced response of RLC circuits.

Skill Development

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UNIT-IV: **(12 periods)**

Resonance: Series and parallel resonant circuits, bandwidth and Q-factor.

Three phase circuits: Balanced and unbalanced circuits.

EMPLOYABILITY

UNIT-V: **(12 periods)**

Concept of Duality, initial and final value theorems in s-domain, Application of Laplace transforms to electrical circuits.

Network Topology: Definitions – Graphs, Tree, Basic cut set and basic tie set matrices for planar or non-planar networks**.**

Network Synthesis: Elementary Synthesis Operation, LC Network Synthesis, Properties of RC Network Functions, Foster and Cauer Forms of RC and RL Networks.

Skill Development

Text books:

1. W. H. Hayt jr & J. E. Kemmerly, Engineering circuit analysis, 7^{th} edition, Mc.graw hill publications 2006.
2. M. E. Vanvalkunberg, Network analysis, 3^{rd} edition, prentice Hall of India 1974.
3. M. E. Van valkunberg, Modern Network analysis.

REFERENCES:

1. C K Alexander & M. N. O. Sadiku, Fundamentals of Electric Circuits, 5^{th} Edition, Published by McGraw-Hill.
2. Engineering Network Analysis & Filter Design by GOPAL.G. BHISE, Umesh Publications, publishers of science and technical books.

ELECTRONIC DEVICES & CIRCUITS

EEE 215 **Credits: 3**

Instruction: 3 periods & 1 Tut / Week Sessional Marks: 40

End Exam : 3 Hours End Exam Marks : 60

COURSE OBJECTIVES

- To know about the basics of Semi conductor Physics and PN Junction.
- To gain knowledge about various types of diodes and their applications.
- To understand the working of rectifier circuits.
- To know the basic working of BJT, FET.
- To understand the various biasing techniques.

COURSE OUTCOMES

By the end of this course, student will be able to

CO1: Design simple electronic circuits to accomplish a specific function.

CO2: Understand the voltage regulation.

CO3: Understand the working of transistors.

CO4: Design and analyze the basic amplifier circuits with proper bias stabilization.

CO5: Choose an appropriate device for given applications and use it satisfactorily.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	1	1	0	1	0	1	0	0	1	0	1
CO2	2	2	2	1	1	0	1	0	1	0	0	1	0	1
CO3	2	2	2	1	1	0	1	0	1	0	0	1	1	1
CO4	2	2	2	1	1	0	1	0	1	0	0	1	1	1
CO5	2	2	2	1	1	0	1	0	1	0	0	1	0	1

SYLLABUS

Unit1: PN junction diode and its applications **(10 periods)**
Open circuited p-n junction, biased p-n junction diode, energy band diagram of PN junction Diode, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Transition and Diffusion capacitance of diode.
Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Ripple Factor and Regulation Characteristics.

Unit 2: Special Semiconductor Devices **(8 periods)**
Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Photo diode, Varactor diode, Tunnel Diode, Schottky barrier diode, UJT. Construction, operation and characteristics of all the diodes.

Unit 3: Transistor Characteristics **(12 periods)**
Junction transistor, transistor current components, transistor as an amplifier, transistor configurations, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Comparison of CE, CB and CC Configurations. α, β and ɣ Parameters and the relation between them, typical transistor junction voltage values.

Unit 4: FET **(10 periods)**
FET types, construction, operation, characteristics, parameters, FET as a Voltage variable resistor, MOSFET-types, construction, operation, characteristics, comparison between BJT,JFET and MOSFET.

Unit 5: Transistor Biasing and Thermal Stabilization **(10 periods)**
Need for biasing, operating point, load line analysis, BJT biasing methods-fixed bias, collector to base bias, self bias. Bias compensation, Thermal runaway, Thermal stability. FET Biasing-methods and stabilization.

Text Books:
1. Electronic Devices and Circuits, Jacob Millman and D. Halkias, McGraw Hill.
2. Electronic Devices and Circuits Theory, Boylsted, Prentice Hall Publications.

References:

1. Electronic Devices and Circuits-David A.Bell, Oxford University Press, Fifth Edition.
2. Integrated Electronics- Jacob Millman, C. Halkies, C.D. Parikh, Tata Mc-Graw Hill, 2009.

NETWORKS LAB

EEE 217 **Credits: 2**

Instruction: 3 periods / Week Sessional Marks: 50

End Exam : 3 Hours End Exam Marks : 50

Course Objectives:

At the end of the Course, Students are able to understand

- Can analyze theorems using Mesh and Nodal analysis methods.
- Can find equivalent circuits for theorem using D.C. source.
- Can find equivalent circuits for theorem using A.C. source.
- Calculation of power and network parameters.
- Able to calculate resonant frequency, quality factor for Series & Parallel resonance circuits.

Contribution to Outcomes:

Upon the completion of this course, students should demonstrate the ability to

CO1: Can Understand and verify the network theorems.

CO2: Understood the Series & Parallel resonance, importance of quality factor.

CO3: Calculate two port network parameters for a given network.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	0	0	1	1	0	1	1	1
CO2	3	2	1	1	1	1	0	0	1	1	0	1	1	1
CO3	3	2	1	1	1	1	0	0	1	1	0	1	1	1

List of Experiments:

1. Verification of ohm's law and filament lamp characteristics.
2. Verification of Kirchhoff's Laws.
3. Verification of superposition theorem.
4. Verification of Thevenin's and Norton's Theorems.
5. Verification of Maximum power transfer theorem.
6. Verification of Compensation theorem.
7. Verification of Milliman's and Tellegen's Theorems.

Skill Development

8. Verification of reciprocity theorem.
9. Resonance of series and parallel R-L-C circuits.
10. Two Port network parameters.
11. Calculation of self & mutual inductances, Co-efficient of coupling.
12. Transient response of an series R-L-C circuit with different R,L,C values.

ELECTRONIC DEVICES & CIRCUITS LAB

EEE 218 **Credits: 2**
Instruction: 3 periods / week Sessional Marks: 50
End Exam : 3 Hours End Exam Marks : 50

COURSE OBJECTIVES

- To observe the characteristics of different diodes and transistors practically.
- To Design and construct simple electronic circuits to accomplish a specific function, e.g. designing rectifiers, designing amplifiers etc.

COURSE OUTCOMES

At the end of the course the student will be able to

CO1: Understand the use of RPS and CRT.
CO2: Verify the working of diodes, transistors and their applications.
CO3: Set up a bias point in a transistor
CO4: Design simple hardware circuits using diodes and transistors.
CO5: Design simple DC power supply circuits.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	1	1	0	1	0	1	0	0	1	0	1
CO2	2	2	2	1	1	0	1	0	1	0	0	1	0	1
CO3	2	2	2	1	1	0	1	0	1	0	0	1	0	1
CO4	2	2	2	1	1	0	1	0	1	0	0	1	0	1
CO5	2	2	2	1	1	0	1	0	1	0	0	1	0	1

LIST OF EXPERIMENTS

1. Study of CRO and Applications
2. V-I Characteristics of PN Junction Diode
3. V-I Characteristics of Zener Diode and Zener regulator characteristics.
4. V-I Characteristics of LED
5. Half-wave rectifier without and with filter
6. Full-wave rectifier without and with filter
7. Characteristics of BJT in CB configuration, h-parameters
8. Characteristics of BJT in CE configuration, h-parameters
9. Drain and transfer characteristics of JFET
10. Transistor as a switch
11. Implementation of logic gates using diodes and transistors.
12. SCR Characteristics

ENGINEERING MATHEMATICS-IV

EEE 221 **Credits: 3**
Instruction: 3 periods & 1 Tut / Week Sessional Marks: 40
End Exam : 3 Hours End Exam Marks : 60

Course Objective :

- The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects.
- Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Outcomes:

At the end of the course student should be able to:

CO1: Understanding the characteristics and properties of Z-transforms and apply the concepts of Z-Transform in Digital Systems.

CO2: Familiarize the formation of Difference Equations and method of solving difference equations.

CO3: Understand, interpret and use the basic concepts: analytic function, harmonic function, Taylor and Laurent series, singularity.

CO4: Study the concepts of Residues, evaluating definite integrals using technique of residues and understand the concepts of conformal mappings.

CO5: Analyze the Statistical data by using statistical tests (based on small sample and large sample) and to draw valid inferences based on the analysis of statistical data.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	0	0	1	0	3	0	0	1	0	0	1	1
CO2	3	2	0	0	1	0	2	0	0	1	0	0	1	0
CO3	3	1	0	0	1	0	2	0	0	1	0	0	1	0
CO4	3	1	0	0	1	0	2	0	0	1	0	0	1	1
CO5	3	1	0	0	1	0	3	0	0	1	0	0	1	1

SYLLABUS

UNIT -I :
FUNCTIONS OF A COMPLEX VARIABLE **(14 Periods)**

Introduction –Limit of a Complex function- Derivative of (z) – Analytic functions-Harmonic functions - Applications to Flow problems. Complex Integration- Cauchy's Theorem- Cauchy's Integral Formula –Series of Complex terms (Statements of Taylor's and Laurent's Series without proof) - Zeros of an Analytic function - Residues - Calculation of Residues - Evaluation of Real Definite Integrals (Integration around the unit circle, Integration around the small semi circle , Indenting the Contours having poles on the real axis).
Geometric representation of f , Some standard transformation ($w = z + c, w = cz , w = \frac{1}{z} , w = \frac{az+b}{cz+d}$).

UNIT –II :
FINITE DIFFERENCES & INTERPOLATION **(12 Periods)**

Finite Differences – Forward differences – Backward differences – Central differences – Differences of a Polynomial – Factorial Notation – Other difference operators – To find one or more missing terms – Newton's Interpolation Formulae – Central Difference Interpolation Formulae - Interpolation with Unequal Intervals – Lagrange's interpolation formula – Inverse Interpolation.

UNIT-III:
NUMERICAL DIFFERENTIATION AND INTEGRATION **(10 Periods)**

Numerical Differentiation – Formulae for derivatives – Maxima and Minima of a Tabulated Function – Numerical Integration – Newton-Cotes Quadrature Formula – Trapezoidal rule – Simpson's One-Third rule , Simpson's Three-Eighth rule.

UNIT–IV:
Z – TRANSFORMS **(12 Periods)**
Introduction – Definition - Some Standard Z-Transforms –Linearity Property –Damping Rule – Some Standard Results - Shifting U_n to the right , Shifting U_n to the left – Two basic theorems (Initial Value Theorem and Final Value Theorem) – Convolution Theorem – Convergence of Z-transforms – Two sided Z - transform of U_n - Evaluation of inverse Z- transforms (Power Series Method , Partial Fraction Method , Inverse integral method) - Applications to Difference equations.

UNIT -V :
SAMPLING THEORY **(12 Periods)**

Introduction – Sampling Distribution – Testing a hypothesis – Level of Significance – Confidence Limits – Test of Significance of Large samples (Test of significance of single mean, difference of means) – Confidence limits for unknown – Small samples – Students t-distribution – Significance test of a sample mean – Significance test of difference between sample means – Chi-Square (χ^2) Test – Goodness of fit.

Text Books:

1. Dr. B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, New Dehli.

Reference books:

1. A Text book on Engineering Mathematics by N.P. Bali Etal, Laxmi pub.(p)Ltd , 2011.
2. Advanced Engineering Mathematics by H.K.Dass , S.Chand Publications, 2007.
3. Advanced Engineering Mathematics by Erwin kreyszig, John Wiley Publications, 1999.

ELECTRICAL MEASUREMENTS

EEE 222 **Credits: 3**
Instruction: 3 periods & 1 Tut / Week Sessional Marks: 40
End Exam : 3 Hours End Exam Marks : 60

Course Objectives:

At the end of the Course, Students are able to understand

- Construction details of various measuring instruments like moving coil, moving iron, dynamometer and electrostatic instruments.
- Extension of range of instruments.
- Various AC & DC bridge methods for the measurement of R, L and C.
- Testing of Ring Specimens.
- Operation of D.C & A.C potentiometers.

Contribution to Outcomes:

Upon the completion of this course, students should demonstrate the ability to

CO1: Design the shunts and multipliers required to extend the range of instruments.
CO2: Understand the operational features of various measuring devices
CO3: Understand and design bridges for the measurement of R, L & C.
CO4: Understand the determination of B-H curve and Hysteresis loop of ring specimens.
CO5: Understand the operation of AC and DC potentiometers and their applications.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	2	0	0	2	0	0	1	0	1
CO2	3	3	3	3	2	2	0	0	2	0	0	1	3	0
CO3	3	3	3	3	1	2	0	0	2	0	0	1	0	0
CO4	3	2	1	3	1	2	0	0	2	0	0	1	1	1
CO5	3	3	3	3	2	2	0	0	2	0	0	1	3	1

SYLLABUS

UNIT-I **(10 periods)**

Instruments: Objectives of Measurements, Analog Versus Digital Measurements, Sources of Measurement Error, Static characteristics of Measuring Instruments, Instruments: Ammeter, Voltmeter, Expression for Torque of Moving Coil, Moving Iron, Dynamometer, and Electrostatic Instruments. Extension of range of Instruments.

Skill Development

UNIT-II **(10 periods)**

Measurement of Power and Energy: Dynamometer type Wattmeter's and Torque Expression. Measurement of reactive Power. Single Phase Induction type Energy Meters. Driving Torque and Braking Torque Equations, Errors and Compensation, Power Factor Meters, Frequency Meters, Electrical Resonance and Weston type of SynchroScope.

EMPLOYABILITY

UNIT-III **(18 periods)**

Bridge Methods: Measurement of Resistance by Using Wheatstone's bridge, Kelvin's Double Bridge, Loss of Charge Method and Megger. Measurement of Inductance by Using Maxwell's Inductance, Maxwell's Inductance-Capacitance, Anderson's, Owen's and Hays Bridge, Measurement of Frequency by Using Wien's bridge. Measurement of Capacitance by Using Desauty's and Schering's Bridges. Wagner's Earthing Device.

Skill Development

UNIT-IV **(12 periods)**

Magnetic Measurements: Calibration of Ballistic Galvanometer using Hibbert's magnetic standard, Flux Meter operation, extension range of Flux meters, Determination of Leakage Factor by using Flux Meter. Determination of B-H Curve and Hysteresis Loop Using CRO.

Skill Development

UNIT-V **(10 periods)**

Potentiometers: Basic slide wire potentiometer, Crompton's D.C. Potentiometer, A.C. Polar and co-ordinate Type Potentiometers Applications of DC and AC potentiometers. Use of potentiometer in Frequency, Phase and Amplitude measurements.

Skill Development

Instrument Transformers: CTs, PTs - Ratio and Phase angle errors and their reduction.

Skill Development

Text Book:

1. A.K. Sawhney, Electrical and Electronic Measurements and Instrumentation, DhanpatRai & Sons, Delhi, 19th Edition, 2011.

Reference Books:

1. E.W. Golding & Widdis, Electrical Measurements, 5th Edition, Wheeler Publishing.
2. J.B Gupta, Electrical Measurements and Measuring Instruments.
3. Electronic Measurements by Hellfric & Cooper.

PERFORMANCE OF ELECTRICAL MACHINES–I

EEE 223 **Credits: 3**

Instruction: 3 periods & 1 Tut / Week Sessional Marks: 40

End Exam : 3 Hours End Exam Marks : 60

Course Objectives:

At the end of the Course, Students are able

- To understand the construction and operation of DC Machines.
- To study the various starting and testing methods of DC machine
- To analyze different speed control techniques of DC Machine.
- To understand the working and equivalent circuit parameters of single phase transformer.
- To analyze the performance of three phase transformers.

Contribution to Outcomes:

Upon the completion of this course, students should demonstrate the ability to

CO1: Understand the construction, principle of operation of DC Machines.
CO2: Performance and testing of DC Motors.
CO3: Speed control of DC Motors.
CO4: Constructional details, principle of operation and equivalent circuit parameters of Transformers.
CO5: Understand different connections of Poly phase transformers and auto transformer.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	3	2	2	0	0	0	0	0	2	1	0
CO2	3	3	1	3	2	2	0	0	0	0	0	2	1	2
CO3	3	3	1	3	2	2	0	0	0	0	0	2	1	0
CO4	3	3	1	3	2	2	0	0	1	0	0	2	3	3
CO5	3	2	1	2	2	2	0	0	0	0	0	2	3	3

SYLLABUS

UNIT – I **(14 Periods)**

DC Generators: principles of operation, constructional features, generated e.m.f., voltage induced in d.c. machine, collection and flow of current from armature, commutation process and interpoles, armature reaction and effect on main flux and commutation, compensating winding, methods of excitation, open circuit characteristics, external characteristics of generators, parallel operation

Skill Development

UNIT – II **(10 Periods)**

D.C. Motors: torque expression**,** torque and speed equations, characteristics of different motors, speed control of d.c. motors, starting and starters.

Skill Development

UNIT – III **(16 Periods)**

Testing of D.C. Motors: losses and efficiency, brake test, Swinburne's test, Hopkinson's test, Retardation test, field's test, separation of losses.

Skill Development

UNIT – IV **(12 Periods)**

Single phase Transformers: principles of operation, constructional features, equivalent circuit, vector diagram, voltage regulation and efficiency, parallel operation and load sharing,

Skill Development

UNIT – V **(12 Periods)**

Polyphase transformers:

Three winding transformers, poly phase connections and scott connection, tap changing, cooling methods and transformer oil, Auto transformers.

EMPLOYABILITY

TEXT BOOKS:

1. Nagarath and Kotari, Electrical Machines, TMH Publishers.
2. Dr. P.S. Bimbhra, " Electrical Machinery", Khanna publishers 2004.
3. Clayton and Hancock, "Performance and Design of Direct Current Machines", CBS publishers 2004.
4. M .G Say, "The Performance and Design of Alternating Current Machines", CBS Publishers.

REFERENCE BOOKS:

1. S.K. Bhattacharya, "Electrical Machines", Tmh, 1998

ANALOG ELECTRONIC CIRCUITS

EEE 224 **Credits: 3**

Instruction: 3 periods & 1 Tut / Week Sessional Marks: 40

End Exam : 3 Hours End Exam Marks : 60

COURSE OBJECTIVES

The aim of this course is to familiarize the student with the analysis and design of basic transistor amplifier circuits. This course relies on elementary treatment and qualitative analysis and makes use of simple models and equations to illustrate the concepts involved.

The main objectives of this course are:

- To provide an overview of amplifiers, feedback amplifiers and oscillators.
- To gain the knowledge on existing and future analog circuits.
- To Analyze various tuned amplifiers

COURSE OUTCOMES

At the end of the course the student will be able to

CO1: Perform the analysis of small signal and low frequency hybrid model circuits.

CO2: Determine various parameters of an amplifier like gain, input impedance and output impedance and bandwidth.

CO3: Know about various distortions that occur in amplifiers.

CO4: To apply the concepts of feedback analysis to the design of amplifiers to meet or exceed stated specifications.

CO5: To design and analyze tuned amplifiers and oscillators to meet or exceed stated specifications.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	0	0	0	0	0	0	0	0	0	1
CO2	3	1	1	3	0	0	0	0	1	0	0	0	0	1
CO3	3	1	1	3	0	0	0	0	1	0	0	0	0	1
CO4	3	2	1	2	0	0	0	0	0	0	0	0	0	1
CO5	3	3	3	1	0	0	0	0	2	0	0	0	0	1

SYLLABUS

Unit 1: Single stage Amplifiers (12 Hrs)

Transistor hybrid model, determination of h parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis. FET small signal model. Analysis of Common source amplifier.

Unit 2: Multi stage Amplifiers (10Hrs)

RC Coupled Amplifiers using BJT and FET- Low and High Frequency Response of an RC coupled stage, Band width of multistage amplifiers, Concept of gain bandwidth product, Distortion in Amplifiers.

Unit 3: Feedback Amplifiers (10Hrs)

Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

Unit 4: Tuned Amplifiers (10 Hrs)

Introduction, Q-Factor, small signal tuned amplifier, capacitance coupled single tuned amplifier, double tuned amplifiers, effect of cascading single tuned amplifiers on band width, effect of cascading double tuned amplifiers on band width, staggered tuned amplifiers, stability of tuned amplifiers.

Unit 5:

Sinusoidal Oscillators (10 Hrs)

Condition for oscillations –LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators – Frequency and amplitude Stability of Oscillators Crystal Oscillators – RC Oscillators -- RC Phase Shift and Wein Bridge Oscillators.

Text Books:

1. Integrated Electronics- J. Millman and C.C. Halkias, Tata Mc Graw- Hill, 1972.
2. Microelectronic Circuits-Sedra A.S. and K.C. Smith, Oxford University Press, Sixth Edition.

References

1. Electronic Devices and Circuits – Mottershead
2. Electronic Circuit Analysis and Design – Donald A. Neaman, Mc Graw Hill.
3. Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, Tenth Edition.

SIGNALS & SYSTEMS

EEE 225 **Credits: 3**
Instruction: 3 periods & 1 Tut / Week Sessional Marks: 40
End Exam : 3 Hours End Exam Marks : 60

Course Objectives:

Coverage of continuous and discrete-time signals and systems, their properties and Knowledge of time-domain representation and analysis concepts as they relate to Difference equations, impulse response and convolution, etc. Knowledge of frequency-domain representation and analysis concepts using Fourier Analysis tools, Z-transform Concepts of the sampling process.

Course Outcomes:

At the end of the course the student will be able to

CO1: Characterize and analyze the properties of CT and DT signals and systems.
CO2: Analyze CT and DT systems in Time domain using convolution.
CO3: Represent CT and DT systems in the Frequency domain using Fourier Analysis tools like CTFS, CTFT, DTFS and DTFT
CO4: Conceptualize the effects of sampling a CT signal.
CO5: Analyze CT and DT systems using Laplace transforms and Z Transforms.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	1	0	0	0	1	1	0	1	0	1
CO2	2	2	2	3	1	0	0	0	1	1	0	1	0	1
CO3	2	2	2	3	1	0	0	0	1	1	0	1	0	1
CO4	2	2	2	3	1	0	0	0	1	1	0	1	0	1
CO5	2	2	2	3	1	2	0	0	1	1	0	1	0	1

SYLLABUS

UNIT-I Signals and systems: (12 periods)

Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and aperiodic, random signals, CT systems and DT systems, Basic properties of systems .

UNIT-II Linear Time Invariant Systems: (12 periods)

Discrete Time Linear Time Invariant Systems, Convolution Sum , Continuous Time Linear Time Invariant Systems, Convolution Integral ,properties of LTI systems , LTI systems described by linear constant coefficient differential and difference equations.

UNIT-III -Analysis of CT Signals: (12 periods)

Fourier series analysis – Spectrum of CT signals – Fourier transform and Laplace transform in signal analysis, Differential equation – Block diagram representation – Impulse response – Convolution integral – Frequency response – Fourier transform and Laplace transform in analysis.

UNIT-IV- Analysis of DT Signals: (12 periods)

Spectrum of DT signals – Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Z-transform and its Properties in signal analysis, Inverse Z-Transforms, Difference equations – Block diagram representation – Impulse response – convolution SUM – Frequency response - Fourier transform and Laplace transform in analysis.

UNIT-V Sampling: (12 periods)

Sampling Theorem: Representation of continuous time signals by its sample - Sampling theorem – Reconstruction of a Signal from its samples, aliasing – discrete time processing of continuous time signals using Fourier's Transform, sampling of band pass signals.

Text Books:

1. A.V. Oppenheim, A.S.Willsky and S.H.Nawab -Signals & Systems, Pearson . [UNIT-1, UNIT-2,UNIT-5]
2. S. Haykin & B.V.Veen, Signals and Systems- John Wiley. [UNIT-3,UNIT-4]

References:

1. J.G. Proakis & D.G.Manolakis- Digital Signal Processing Principles, Algorithms and Applications, PHI.
2. A. Nagoor Kani- Signals and Systems- McGraw Hill
3. E W Kamen &BS Heck- Fundamentals of Signals and Systems Using the Web and Matlab- Pearson.
4. Rajeswari K.Raja, Rao B.Visvesvara -Signals and systems , PHI.

MICROPROCESSORS AND MICRO CONTROLLERS

EEE 226 | **Credits: 3**
Instruction: 3 periods & 1 Tut / Week | Sessional Marks: 40
End Exam : 3 Hours | End Exam Marks : 60

COURSE OBJECTIVES

- To understand the basic concepts of Microprocessors.
- Knowledge on instruction-set & implementing them for many applications.
- Knowledge on different Interfacing techniques of processor.
- Differentiation between Processors &Controller.
- Architecture, Instruction –set & Interfacing of microcontroller.

COURSE OUTCOMES

CO1: Students will be able to analyze the architectures of 8085 .
CO2: Understands the addressing modes and interfacing with CPU.
CO3: Students will be able to analyze the architectures of 8086.
CO4: Understands the basic interfacing peripherals to 8085.
CO5: Analyze the architecture of 8051 microcontroller.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	2	2	3	0	0	0	3	0	0	2	2	2
CO2	0	0	2	2	3	0	0	0	3	0	0	2	2	2
CO3	0	0	2	2	3	0	0	0	3	0	0	2	2	2
CO4	0	0	2	2	3	0	0	0	3	0	0	2	2	2
CO5	0	0	2	2	3	0	0	0	3	0	0	2	2	2

SYLLABUS

UNIT-I: **(14 periods)**

INTRODUCTION TO MICROPROCESSOR ARCHITECTURE (8085): Introduction, internal architecture and functional description of 8085 processor-instruction set and timing diagrams.

Skill Development

UNIT-II : **(08 periods)**

MEMORIES: RAM, ROM, PROM, static and dynamic memories-memory addressing-interfacing memory to cpu.

Skill Development

UNIT-III: **(12 periods)**

INTRODUCTION TO MICROPROCESSOR ARCHITECTURE (8086):

Introduction and evolution of microprocessor architecture of 8086, register organization of 8086, memory organization of 8086, general bus operation of 8086.

Skill Development

UNIT-IV: **(12 periods)**

INTERFACING WITH ADVANCED DEVICES:

Stepper motor interfacing, key board/display device: 8279 block diagram and its operation, 8251 (USART), block diagram and functions of each block, timer-8253 block diagram and modes of operation.

EMPLOYABILITY

UNIT-V: **(14 periods)**

INTERFACING AND INDUSTRIAL APPLICATIONS OF 8051:

Applications of micro controllers, interfacing 8051 to led's, push button, relay's and latch connections, keyboard interfacing, interfacing seven segment display, adc and dac interfacing.

Skill Development

TEXT BOOKS:

1. Microprocessors and Interfacing, Douglas V Hall, Mc-Graw Hill, 2nd Edition.
2. Kenneth J Ayala, "The 8051 Micro Controller Architecture, Programming and Applications", Thomson Publishers, 2nd Edition.
3. R.S. GAONKAR: Processor Architecture, Programming and Applications With The 8085/8080A, Wiley Eastern Ltd.

REFERENCE BOOKS:

1. R.S. Kaler, " A Text book of Microprocessors and Micro Controllers", I.K. International Publishing House Pvt. Ltd.
2. Ajay V. Deshmukh, "Microcontrollers – Theory and Applications", Tata McGraw-Hill Companies –2005.

ELECTRICAL MEASUREMENTS LAB

EEE 227 | **Credits: 2**
Instruction: 3 periods / Week | Sessional Marks: 50
End Exam : 3 Hours | End Exam Marks : 50

Course Objectives:

The main objectives of the course are to enable the students to understand

- Calibrate the Dynamometer type wattmeter and Dynamometer type power factor meter.
- Calibrate the single phase Energy meter.
- Measurement of Inductance and Capacitance by using various bridge methods.
- Measurement of single phase and three phase Power by using different methods.
- Calibrate the ammeter and voltmeter by using AC Potentiometer.

Contribution to Outcomes:

Upon the completion of this course, students will be able to

CO1: Understand the operational features of various measuring devices

CO2: Understand and design bridges for the measurement of R, L & C.

CO3: Understand the operation of AC potentiometers and their applications.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	0	1	0	0	1	2	0	1	0	0
CO2	3	3	2	3	0	1	0	0	1	2	0	1	2	0
CO3	3	3	2	3	0	1	0	0	1	2	0	1	0	0

List of Experiments:

Skill Development & EMPLOYABILITY

1. Calibration and testing of single phase Energy Meter.
2. Calibration of Single phase Energy Meter by using Phantom Loading.
3. Calibration of Dynamometer type wattmeter by using Direct Loading (through CTs and / or PTs).
4. Measurement of 3 phase power by using two wattmeter method.
5. Calibration of Dynamometer type wattmeter by using Phantom Loading.
6. Calibration of Dynamometer type Power Factor meter.
7. Measurement of 3 Phase Reactive Power by using single wattmeter.
8. Measurement of Inductance by using Anderson’s bridge.
9. Measurement of Inductance by using Maxwell’s Inductance-Capacitance bridge.
10. Measurement of Inductance by using Kelvin’s Double bridge.

11. Measurement of Capacitance by using Schering bridge.
12. Measurement of Capacitance by using Desaugty's bridge.
13. Power Measurement by using 3 ammeter and 3 voltmeter method.
14. Calibration of ammeter and voltmeter by using AC Potentiometer.
15. Finding the parameters of a choke coil.

ANALOG ELECTRONIC CIRCUITS LAB

EEE 228 **Credits: 2**
Instruction: 3 periods / Week Sessional Marks: 50
End Exam : 3 Hours End Exam Marks : 50

COURSE OBJECTIVES

The aim of this course is to

1. Analyze amplifiers for frequency response
2. Identify, select, and handle transistors.
3. Analyze feedback circuits , amplifier circuits and oscillator circuits
4. To provide an overview of amplifiers, feedback amplifiers and oscillators.
5. Design and construct simple electronic circuits to accomplish a specific function, e.g., designing amplifiers

COURSE OUTCOMES

At the end of the course the student will be able to

CO1: Acquire a basic knowledge in solid state electronics including voltage transistor, power transistors and operational amplifier.
CO2: Design analog electronic circuits using discrete components.
CO3: Observe the amplitude and frequency responses of common amplification circuits.
CO4: Measure various parameters of analog circuits and compare experimental results in the laboratory with theoretical analysis.
CO5: Design and construct simple electronic circuits to accomplish a specific function, e.g., designing amplifiers, oscillators.

Mapping of course outcomes with program outcomes and program specific outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	2	0	1	1	0	0	0	0	0	0	1
CO2	1	2	3	2	0	1	1	0	0	0	0	0	0	1
CO3	1	2	3	2	0	1	1	0	0	0	0	0	0	1
CO4	1	2	3	2	0	1	1	0	0	0	0	0	0	1
CO5	1	2	3	2	0	1	1	0	0	0	0	0	0	1

LIST OF EXPERIMENTS

1. Design of CE amplifier and obtain its frequency response.
2. Design of CC amplifier and obtain its frequency response.
3. Frequency response of two stage -RC coupled amplifier.
4. Frequency response of Common source FET amplifier.
5. Current series feedback amplifier.
6. Voltage shunt feedback amplifier.
7. Hartley oscillator.
8. Colpitt's oscillator.
9. RC Phase - Shift Oscillator.
10. Wein - Bridge Oscillator.
11. Tuned Voltage Ampl ifier.

OPEN ELECTIVE-I RENEWABLE ENERGY TECHNOLOGIES	
EEE 311	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Course Objectives:

- Analysis to Non-Conventional Energy Sources.
- Analysis working of Solar Energy, Wind Energy and Energy from Oceans etc.
- Animated working videos of Solar, Wave Energy, Geo-Thermal, Wind Energy Power Plants etc. are shown to Students in the class.

Course Outcomes:

At the end of the course student should be able to:	
1.	Acquire knowledge on the Non-Conventional Energy Sources related to electrical and electronics engineering.
2.	Acquire knowledge about the fundamental principles of Solar Energy, Wind Energy, Energy from Oceans etc.
3.	Acquire knowledge on the Non-Conventional Energy Sources.
4.	Acquire and establish on the small Bio-Gas Energy Power Plant in home.
5.	Apply the acquired knowledge in Non-Conventional Energy Sources for the benefit of the society

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	2	0	2	2	1	2	0	0	1	0	1	1	0
	2	1	2	0	2	2	1	2	0	0	1	0	1	1	0
	3	1	2	0	2	2	1	2	0	0	1	0	1	1	0
	4	1	2	0	2	2	1	2	0	0	1	0	1	1	0
	5	1	2	0	2	2	1	2	0	0	1	0	1	1	0

SYLLABUS

UNIT I: **[15 Periods]**

Introduction: Introduction to Energy Conversion, Principle of Renewable Energy Systems, Technical and Social Implications, Solar Radiation, Thermoelectric Conversion, Principles of Solar Energy collection, Characteristics and principles of different types of collectors and their efficiencies. Solar energy applications, water heaters, air heaters, solar cooling, solar cooking, solar drying and power generation, solar tower concept, solar pump, Introduction to Photovoltaic cells, PV array and PV module, Maximum power point tracking system.

Skill Development

UNIT II: **[10 Periods]**

Wind energy: Wind energy, Characteristics, Aerodynamics, Power extraction, Types of wind machines, Performance of Wind Machines, Wind Mills, Applications, Economics of wind power.

Skill Development

UNIT III: **[10 Periods]**

Ocean & Geothermal Energy: Ocean Thermal Energy Conversion Systems, Tidal and Wave power applications. Principle of working of Geothermal Power Plants, Advantages and Disadvantages over other energy forms, Applications of Geothermal Energy.

Skill Development

UNIT IV: **[10 Periods]**

Bio- Energy: Energy from Bio-mass, Bio conversion processes. Bio-gas generation and utilization, Bio-gas plants various types, Industrial Wastes, Municipal waste, Burning, Plants, Energy from the Agricultural wastes.

Employability

UNIT V: **[15 Periods]**

MHD Power Generation, Fuel Cells & Hybrid- Energy System: MHD Generators, Application of MHD generation, Fuel cells types, applications. Diesel Generator and Photo-Voltaic System, Wind-Diesel Hybrid System, Wind-Photovoltaic Systems.

Employability

Textbooks:

1. Non-Conventional Energy Sources, G.D.Rai, Khanna publishers, Fourth Edition, 2009.
2. Wind electrical systems, S.N.Bhadra, D. Kastha, S. Banerjee Oxford University press.

References:

1. Solar Energy: Principles of Thermal Collection and Storage, Sukhatme, S.P., Tata McGraw-Hill, New Delhi.
2. Fuel Cell Systems, James Larminie, Andrew Dicks, John Weily & Sons Ltd.
3. Wind Energy Explained, J.F.Manwell, J.G.McGowan, A.L.Rogers, John Weily & Sons
4. MHD Power Generation Engineering Aspects, E.J. Womack, Chapman and Hall Publication.
5. Wind Electrical Systems, S.N.Bhadra, D. Kastha, S. Banerjee Oxford University press.

DATA STRUCTURES	
EEE 312	Credits : 3
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

2017-18/266,2018-19/280,2019-20/281

Pre-requisites: Any programming language with concepts of arrays and strings, structures, functions and recursion.

Course Objectives:

- Introduce and emphasize fundamental concepts of data structures.
- Development and implementing efficient algorithms.
- Effective software engineering practice.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Understand the concepts of arrays, recursion and structures
2.	Understand and apply various data structure such as Linked lists, Stacks, Queues, Tress and Graphs.
3.	Implement linked data structure to solve various problems.
4.	Implement algorithms and how to apply customary algorithms for searching and sorting.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	0	0	2	0	0	0	0	0	2	2	0	0	1	0
	2	0	0	2	0	0	0	0	0	2	2	0	0	1	0
	3	0	0	2	0	0	0	0	0	2	3	0	0	1	0
	4	0	0	3	0	0	0	0	0	2	2	0	0	1	0

SYLLABUS

UNIT I: **[12 Periods]**

Introduction: Revision of 'c' language: over-view

Arrays and functions: Organization and use of one dimensional, two dimensional and multi dimensional arrays, handling of character strings, string operations, concept of function, parameter passing, recursion.

UNIT II: **[12 Periods]**

Structures, pointers & files: Definition of structure and union, programming examples, pointer, pointer expressions, programming examples, file operations and preprocess.

UNIT III: **[12 Periods]**

Linear data structures: Stack representation, operation, queue representation, operations, circular queues, list representation, operations, double linked and circular lists.

UNIT IV: **[12 Periods]**

Non-linear data structure: Trees, binary tree representation, tree transversals, conversion of a general tree to binary tree, representation of graphs.

UNIT V: **[12 Periods]**

Search Techniques: Basic search techniques, tree searching graphics, linked representation of graphs, graph transversal and spanning trees.

Text Books:

1. Balaguruswamy Programming in Ansi C By, May 2008, Tata Mgcraw Hill, 4^{th} Edition.
2. A.M. Tanenbaum -Data Structures Using C, pearson education,7^{th} edition, 2008

Reference Books:

1. Trmbly & Sorenson An Introduction To Data Structures With Applications Tata Mgcrew Hill, 2^{nd} Edition.
2. Kernigan &Writchi -The ‘C’- Programming Language, 2nd Edition, prentice publishers.

PULSE AND DIGITAL CIRCUITS	
EEE 313	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites: Electronic Devices & Circuits (EEE 215), Digital Logic Design (EEE 216) &Analog Electronic Circuits (EEE 224)

Course Objectives:

1. Understand the response of linear circuits for different signals.
2. Determine the voltage transfer characteristics of non linear circuits and also learn about comparators.
3. Understand the operation and design steps of multivibrators.
4. Know about the principle of operation of time base generators.
5. Realize different logic gates using BJT & CMOS.

Course Outcomes:

At the end of the course student will be able to:	
1.	Determine the response of linear circuits for different input signals.
2.	Design application based nonlinear circuits.
3.	Analyze and design the multivibrators.
4.	Understand the operation & application of Miller, Bootstrap circuit and calculate errors present in sweep signals.
5.	Realize logic gates belonging to different logic families such as TTL, CMOS.

Mapping of course outcomes with program outcomes:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	1	3	2	1	1	0	0	2	1	0	0	2	0
	2	1	1	3	2	1	1	0	0	2	1	0	0	2	0
	3	1	1	3	2	1	1	0	0	2	1	0	0	2	0
	4	1	1	3	2	1	1	0	0	2	1	0	0	2	0
	5	1	1	3	2	1	1	0	0	2	1	0	0	2	0

SYLLABUS

UNITI: Linear wave shaping: **[14 Periods]**

High pass and low pass RC circuits and their response for sinusoidal, step voltage, pulse, square wave, ramp and exponential inputs. High pass RC circuit as a differentiator. Low pass RC circuit as an integrator. Attenuators and their application as CRO probe. RL and RLC circuits and their response for step input. Ringing circuit.

UNIT II: Non-Linear Wave Shaping: **[12 Periods]**

Diode clippers.Clipping at two independent levels.Transistor Clippers, Comparator – Diode comparator,Applications of voltage comparators - Clamping operation.Clamping circuits using diode with different inputs.Clamping circuit theorem.Practical clamping circuits.Effect of diode characteristics on clamping voltage.

UNIT III: Multivibrators: **[14 Periods]**
Transistor as a switch - switching times of a transistor.Astable, monostable and bistablemultivibrators using transistors, resolution time of a binary. Methods of improving resolution time – methods of triggering a binary. Schmitt trigger.

UNIT IV: Sweep Circuits: **[10 Periods]**
Voltage sweep - simple exponential sweep generator.Errors that define deviation from linearity, UJT relaxation oscillator – methods of linearising a voltage sweep - bootstrap and miller circuits – current sweep – linearising a current sweep by adjusting the driving waveform.

UNIT V: Logic gates: **[10 Periods]**
Factors defining the performance of the logic gates, transistor – transistor logic gates, emitter coupled logic gates, integrated injection logic (I_2L), PMOS & NMOS logic gates, complementary MOSFET logic gates.

Text Books:

1. J. MillmanandH. Taub “Pulse, Digital and Switching Waveforms”, McGraw – Hill, 1991.
2. K. VenkataRao, K. Rama Sudha&G. ManmadhaRao “Pulse & Digital and Circuits”, McGraw - Hill”L. Strauss, Wave Generation And Shaping ,Mcgraw-Hill 1960.

Reference Books:

1. A. Anand Kumar “Pulse, Digital and Circuits”, Pearson publications, 2nd edition, 2008.
2. L. Srauss “Wave Generation and Shaping”, McGraw – Hill, 1960.”

LINEAR IC'S AND APPLICATIONS	
EEE 314	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

1. Ohm's law, KVL and KCL.
2. Knowledge about analog and digital signals.
3. Knowledge about electronic circuits and their specifications and characteristics

Course Objectives:

The objectives of the course are:

- To provide the students strong fundamentals in the field that is relevant for engineers to design linear circuits using Op-amps.
- To teach various linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of PLL.
- To familiarize the students conversion of data from Analog to Digital and Digital to Analog.
- To introduce concepts of waveform generation and some special function ICs.

Course Outcomes:

By the end of the course student should be able to	
1.	Understand the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques.
2.	Design and analyze linear and non-linear applications of an opamp and special application ICs.
3.	Understand concept of PLL and demonstrate different applications based on it.
4.	Differentiate D/A and A/D convertor, understand their types and analyze their applications.
5.	Demonstrate the applications of waveform generators, timers and Voltage regulators

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	1	3	2	1	1	0	0	2	1	0	0	2	0
	2	1	1	3	2	1	1	0	0	2	1	0	0	2	0
	3	1	1	3	2	1	1	0	0	2	1	0	0	2	0
	4	1	1	3	2	1	1	0	0	2	1	0	0	2	0
	5	1	1	3	2	1	1	0	0	2	1	0	0	2	0

SYLLABUS

UNIT I:Basics of Operational Amplifiers **[9 Periods]**

Advantages of ICs over discrete components – Basic information about op-amps-General operational amplifier stages and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

UNIT II: Applications of Operational Amplifiers **[16 Periods]**

Ideal voltage transfer curve, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparator - Zero crossing detector -Active peak detector, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, - Active filters(Butterworth) - Types

UNIT III: Phase Locked Loop **[10 Periods]**

Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

UNIT IV: Analog to Digital and Digital to Analog Converters **[11 Periods]**

Digital to Analog converters - Binary weighed and R-2R Ladder types - Analog to digital converters - Counter ramp, successive approximation, single and dual slope - DAC/ADC performance characteristics and comparison.

UNIT V: Waveform Generators and Special Function ICs **[14 Periods]**

Sinusoidal Oscillators, Multivibrators and Triangular wave generator, 555 Timer Functional block diagram and description - Monostable and Astable operation - Applications, IC Voltage regulators - Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator -Switched capacitor filter IC

TEXT BOOKS:

1. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001
2. Roy Choudhury and Shail Jain "Linear Integrated Circuits", New Age Science, 2010

REFERENCE BOOKS:

1. Sonde, B.S, ―Introduction to System Design using Integrated Circuits‖, Second Edition, Wiley Eastern Limited, New Delhi, 1994.
2. Ramakant A. Gayakwad, "OP - AMP and Linear IC's ", Prentice Hall, 2002.
3. Michael Jacob J., "Applications and Design with Analog Integrated Circuits ", Prentice Hall of Inida, 1996.
4. Robert F Coughlin and Fedrick F Driscoll ―Operational amplifiers and linear Integrated Circuits‖, 6th edition, Prentice Hall of India, New Delhi, 2006.
5. Richard J. Higgins "Electronics with Digital and Analog Integrated Circuits‖, Prentice Hall of India, New Delhi, 1983.

ELECTRICAL POWER GENERATION AND UTILIZATION	
EEE 315	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

1. Basic Knowledge of Electrical Engineering Concepts.

Course Objectives:

On completion of this subject / course the student should able to:

- Understand concepts and phenomenon of different sources of power generation.
- Understand the process of electrical energy generation by various types of power plants.
- Familiarize the tariff methods for electrical energy consumption in the prospect of optimum utilization of electrical energy.
- Understand the utilization of electrical energy for various applications like heating, welding and illumination.

Course Outcomes:

At the end of the course student will have ability to:	
1.	Articulate power system concepts to engineering problems.
2.	Design power systems components for a specified system and applications.
3.	Calculate usage of power and plot the power / energy demand in the form of graph.
4.	Recognize the need of electrical energy for various applications like heating, welding and illumination.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	3	0	3	1	1	2	0	0	2	0	1	2	0
	2	2	2	0	2	1	1	2	0	0	2	0	1	2	0
	3	2	2	0	1	1	1	2	0	0	2	0	1	2	0
	4	2	2	0	2	1	1	2	0	0	2	0	1	2	0

SYLLABUS

UNIT I: **[12 Periods]**

Introduction: Power generation, comparison of different sources of energy.

Thermal power stations: line diagram, location, coal handling, draught, condensers, cooling water systems.

EMPLOYABILITY

EMPLOYABILITY

UNIT II: **[12 Periods]**

Hydro electric plants: choice of site, hydrology, classification of plants, general arrangement, functions of different components of a hydro plant.

Nuclear power plants: schematic arrangement, components of nuclear reactor, classification of reactors, different power reactors. (video lectures on the related topics may be shown).

SKILL DEVELOPMENT

SKILL DEVELOPMENT

UNIT III: **[12 Periods]**

Gas turbine plants: layout, components of a gas turbine plant, open cycle and closed cycle plants.
Magneto hydro dynamic (MHD) power generation: basic concepts, principle, classification, coal burning MHD steam power plant, gas cooled nuclear MHD power, liquid metal MHD generator.

EMPLOYABILITY

UNIT IV: **[12 Periods]**

Operational aspects of generating stations: load curves and associated definitions, selection of units, load duration curves.
Economic considerations: capital and running costs of generating stations, different tariffs, comparison of costs.

EMPLOYABILITY

EMPLOYABILITY

UNIT V: **[12 Periods]**

Heating and welding: introduction, power frequency and high frequency methods of electric heating, arc furnace. Resistance welding, arc welding, modern welding techniques.
Illumination: definitions, laws of illumination, polar curves, photometry, the electric lamps, cold cathode lamps, light fittings, illumination for different purposes, requirements of good lighting. Indian Electricity Regulations.

EMPLOYABILITY

Text Books:

1. Soni, Gupta, Bhatnagar & Chakrabarti, A Text Book On Power System Engineering, Dhanpat Rai & Co,9th Edition 2011.

Reference Books:

1. C.L.Wadhwa, Generation & Utilization, New Age Publications 6th Edition 2009.
2. S.L.Uppal, Electrics Power Systems By, Khanna Publishers 11th Edition 1984.

LINEAR CONTROL SYSTEMS	
EEE 316	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

1. Network Theory (EEE 214)
2. Signals & Systems (EEE 225)

Course Objectives:

At the end of the course students should understand:

- Generate the transfer functions of mechanical and electrical systems.
- Can adjust the relative stability by using damping factor and undamped natural frequency of the system.
- Can find the stability by using root locus technique, polar plot, nyquist plot, bode plot or M&N circles.

Course Outcomes:

At the end of the course student should be able to:	
1.	Apply signal flow graphs and block diagram reduction techniques to control systems.
2.	Develop mathematical modeling of mechanical and electrical systems.
3.	Analyze the performance of systems with and without feedback control.
4.	Solve control systems using Routh-Hurwitz criterion and root locus technique.
5.	Correlate between time and frequency responses.
6.	Extend the use of bode plots, polar plots and Nyquist plots for stability assessment of control systems.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	2	2	2	2	1	0	0	1	2	0	2	3	0
	2	1	2	2	2	2	1	0	0	1	2	0	2	3	0
	3	1	2	2	2	2	1	0	0	1	2	0	2	3	0
	4	1	2	2	2	2	1	0	0	1	2	0	2	3	0
	5	1	2	2	2	2	1	0	0	1	2	0	2	3	0
	6	1	2	2	2	2	1	0	0	1	2	0	2	3	0

SYLLABUS

UNIT I: **[14 Periods]**

Transfer functions of linear systems-impulse response of linear systems-block diagrams of control systems-signal flow graphs-reduction techniques for complex block diagrams and signal flow graphs.

SKILL DEVELOPMENT

UNIT II: **[8 Periods]**

Introduction to mathematical modelling of physical systems-equations of electrical networks-modelling of mechanical systems- equations of mechanical systems.

SKILL DEVELOPMENT & EMPLOYABILITY

UNIT III: **[12 Periods]**

Time domain analysis of control systems-time response of first and second order systems with standard input signals-steady state performance of feedback control systems-steady state error constants-effect of derivative and integral control on transient and steady state performance of feedback control systems.

SKILL DEVELOPMENT

UNIT IV: **[12 Periods]**

Concept of stability and necessary conditions for stability-Routh-Hurwitz criterion, relative stability analysis, the concept and construction of root loci, analysis of control systems with root locus.

EMPLOYABILITY/ SKILL DEVELOPMENT

UNIT V: **[14 Periods]**

Correlation between time and frequency responses - polar plots, **b**ode plots-log magnitude versus phase plots-all pass and minimum phase systems-Nyquist stability criterion-assessment of relative stability-constant M&N circles.

EMPLOYABILITY/ SKILL DEVELOPMENT

Text Books:

1. Control Systems Engineering by I.J. Nagrath& M.Gopal, Wiley Eastern Limited.
2. Automatic Control Systems by Benjamin C. Kuo, Prentice Hall of India.

Reference Book:

1. Modern Control Engineering by Ogata, Prentice Hall Of India.

DIGITAL ELECTRONICS & MICROPROCESSORS LABORATORY	
EEE 317	**Credits : 2**
Instruction : 3 Periods/Week	**Sessional Marks : 50**
End Exam : 3 Hours	**End Exam Marks : 50**

Prerequisites:

1. Digital Logic Design (EEE 216)
2. Microprocessor and Microcontroller (EEE 226)

Course Objectives:

At the end of the lab course student should understand

- Designing of combinational and sequential circuits.
- Programming of 8085 microprocessor.
- Programming of 8086 microprocessor.
- Programming of 8085 microprocessor to interface with the peripherals.

Course Outcomes:

At the end of the course student should be able to:	
1.	Designing of combinational and sequential circuits.
2.	Programming of 8085 microprocessor.
3.	Programming of 8085 microprocessor to interface with the peripherals.
4.	Programming of 8086 microprocessor.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	0	2	2	2	2	0	0	0	1	1	0	0	1	0
	2	0	2	2	2	2	0	0	0	1	1	0	0	1	0
	3	0	2	2	2	2	0	0	0	1	1	0	0	1	0
	4	0	2	2	2	2	0	0	0	1	1	0	0	1	0

SYLLABUS

DIGITAL ELECTRONICS:

SKILL DEVELOPMENT

1. a. Verification of Truth Tables of basic gates.
   b. Function realization.
2. a. Verification of Demorgan's law.
   b. Realization of logic gates using universal gates.
3. a. Design of half adder, full adder, half subtractor and full subtractor circuits.
   b. Design of Flip-Flops.
4. a. Design of code conversion circuits (BCD – Gray code)
   b.Design of parity generator and parity checker.

MICROPROCESSORS:
Using 8085:

EMPLOYABILTY

1. a. Addition of two 8-bit numbers with & without carry.
   b. Addition of two 16-bit numbers with & without carry.
2. a. Finding largest number in an array.

b. Ascending and descending order of given numbers.

3. a. 8-bit multiplication.
   b. 8-bit division.
4. a. Square of the numbers.
   b. One's compliment.

Using 8086:

EMPLOYABILTY

1. a. Sum of a series of 16 Bit Numbers; Sum:16 Bit.
   b. Smallest 8 bit number in an 8-bit data array.

2. a. Subtraction of two 8-bit numbers with & without carry.
   b. Subtraction of two 16-bit numbers with & without carry.

Interfacing of 8085 to peripheral devices

1. Interfacing of stepper motor.
2. Square wave generation using 8253.
3. Keyboard interfacing 8279 to 8085

LINEAR INTEGRATED CIRCUITS & PULSE AND DIGITAL CIRCUITS LABORATORY	
EEE 318	**Credits : 2**
Instruction : 3 Periods / Week	**Sessional Marks : 50**
End Exam : 3 Hours	**End Exam Marks : 50**

2017-18/272,2018-19/286,2019-20/287

Prerequisites:

1. Pulse and Digital Circuits (EEE 313)
2. Linear IC's and Applications (EEE 314)

Course Objectives:

At the end of the course students should understand:

- To understand the linear and non-linear applications of operational amplifiers(741)
- To familiarize with theory and applications of 555 timers.
- To design and construct waveform generation circuits using Op-Amp
- Understand the response of linear circuits for different signals.
- Determine the voltage transfer characteristics of non linear circuits and also learn about comparators

Course Outcomes:

At the end of the course student should be able to:	
1.	Design the circuits using op-amps for various applications like adder, subtractor, integrator, differentiator and Schmitt trigger
2.	Design active filters for the given specifications and obtain their frequency response characteristics.
3.	Design and analyze multi vibrator circuits using op-amp, Transistor and 555Timer
4.	Design application based on linear and nonlinear circuits
5.	Understand the operation & application of Bootstrap circuit

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	1	3	3	1	1	0	0	2	1	0	0	1	0
	2	1	1	3	1	1	1	0	0	2	1	0	0	1	0
	3	1	1	3	2	1	1	0	0	2	1	0	0	1	0
	4	1	1	3	3	1	1	0	0	2	1	0	0	1	0
	5	1	1	3	1	1	1	0	0	2	1	0	0	1	0

SYLLABUS

List of Experiments:

1) Application of Operational Amplifiers.
2) Design and testing of Active LPF & HPF using op-amp.
3) Design of Schmitt Trigger using op-amp.
4) Design of Astablemultivibrator using a) op amp b) IC 555
5) Line and load regulation of three terminals IC Voltage Regulator.

6) Operation of R-2R ladder DAC and flash type ADC.
7) Design of Bistablemultivibrator using transistor.
8) Observe the process of the linear waver shaping for LPF and HPF.
9) Observe the process of the non- linear waver shaping for Clipper and Clamper.
10) UJT as a relaxation oscillator.
11) Boot strap ramp generator.

PROFESSIONAL ELECTIVE-I ADVANCED CONTROL SYSTEMS AND DESIGN	
EEE 321 (2)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

1. Control Systems (EEE 316)
2. Network Theory (EEE 214)
3. Signals & Systems (EEE 225)

Course Objectives:

At the end of the course student should understand

- Analysis of control system components.
- State variable analysis for the given system.
- Design of controllers and compensators in time domain and frequency domain.

Course Outcomes:

At the end of the course student should be able to:	
1.	Develop the mathematical model for any electrical and mechanical systems.
2.	Develop the state model and identify its stability of the given electrical and mechanical systems.
3.	Observe the effect of a controller to improve the time response.
4.	Design a compensator to improve the response.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	2	2	2	2	1	0	0	1	2	0	2	3	0
	2	1	2	2	2	2	1	0	0	1	2	0	2	3	0
	3	1	2	2	2	2	1	0	0	1	2	0	2	3	0
	4	1	2	2	2	2	1	0	0	1	2	0	2	3	0

SYLLABUS

UNIT-I: **[12 periods]**

Control Systems Components: D.C & A.C. tachometers, synchros, A.C. and D.C. servo motors-stepper motors and its use in control systems, amplidyne – metadyne - magnetic amplifier–principle, operation and characteristics – ward – leonard system.

SKILL DEVELOPMENT

UNIT –II: **[12 periods]**

State Variable Analysis: Concept of state variables & state models, state model for line a continuous time systems, solution of state equation, state transition matrix.

SKILL DEVELOPMENT

UNIT-III: **[12 periods]**

Concept of controllability & observability (simple problems to understand theory), pole placement by state feedback method, design of state feedback controller.

SKILL DEVELOPMENT

UNIT-IV: **[12 periods]**

Introduction and effect of proportional (P), Proportional plus Integral (PI), Proportional plus Derivative (PD), Proportional plus Integral plus Derivative (PID) controller and finding the system response.

SKILL DEVELOPMENT

UNIT-V: **[12 periods]**

Introduction to lag, lead, lag-lead compensating networks and realization of networks. Design of lag, lead and lag-lead compensators by using Root locus technique, design of lag, lead, lag-lead compensators by using Bode plot method.

SKILL DEVELOPMENT

TextBooks:

1. I.J. Nagrath and M.Gopal, 'Control Systems Engineering', New Age International Publications.
2. G.J. GibsonTuetor, 'Control systems components'.
3. B.C. Kuo, 'Automatic control systems' (5th Edition), Prentice Hall of India, 1988.

Reference Books:

1. Ogata K. "Modern Control Engineering", 4th Edition, Prentice Hall
2. Ogata K. "System Dynamics", 3rd Edition, Prentice Hall
3. M. Gopal, "Control Systems Principles and Design", 2nd Edition, Tata Mc Graw Hill
4. Norman S. Nise, "Control Systems Engineering", 3rd Edition, Wiley
5. George Ellis, "Control System Design Guide – A Practical Guide", 3rd Edition, Academic Press

PROFESSIONAL ELECTIVE-I NON-CONVENTIONAL ENERGY SOURCES AND APPLICATIONS	
EEE 321 (3)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Course Objectives:

- Analysis to Non-Conventional Energy Sources.
- Analysis working of Solar Energy, Wind Energy and Energy from Oceans etc.
- Animated working videos of Solar, Wave Energy, Geo-Thermal, Wind Energy Power Plants etc. are shown to Students in the class.

Course Outcomes:

At the end of the course student should be able to:	
1.	Acquire knowledge on the Non-Conventional Energy Sources related to electrical and electronics engineering.
2.	Acquire knowledge about the fundamental principles of Solar Energy, Wind Energy, Energy from Oceans etc.
3.	Acquire knowledge on the Non-Conventional Energy Sources.
4.	Acquire and establish on the small Bio-Gas Energy Power Plant in home.
5.	Apply the acquired knowledge in Non-Conventional Energy Sources for the benefit of the society

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	2	0	2	0	1	1	0	0	1	0	1	1	0
	2	1	2	0	2	0	1	1	0	0	1	0	1	1	0
	3	1	2	0	2	0	1	1	0	0	1	0	1	1	0
	4	1	2	0	2	0	1	1	0	0	1	0	1	1	0
	5	1	2	0	2	0	1	1	0	0	1	0	1	1	0

SYLLABUS

UNIT I: **[13 Periods]**

Solar Energy: Introduction to conventional, non-conventional energy sources, advantages and disadvantages. Basic principle of solar energy, solar radiation, solar collectors, applications, advantages and limitations. Introduction to Photovoltaic cells, PV module and PV array, Maximum power point tracking system.

SKILL DEVELOPMENT

UNIT II: **[13 Periods]**

Wind Energy: Basic principles, components of wind energy conversion system (WECS), classification of WECS, applications, advantages and limitations.

SKILL DEVELOPMENT

UNIT III: **[12 Periods]**

Bio-Energy: Introduction, difference between bio-mass and bio-gas, biomass-energy conversion, wet & dry process, classification of biogas plants, constructional details of few main digesters, biogas from wastes, applications.

EMPLOYABILITY

UNIT IV: **[12 Periods]**

Geo-Thermal Energy: Introduction, sources, prime movers for Geo-Thermal Energy, Applications.

SKILL DEVELOPMENT

Energy from the oceans: Introduction, ocean-thermal electrical conversion (OTEC), open and closed cycles. Tidal energy principles, single and double basin arrangements, wave energy conversion devices.

SKILL DEVELOPMENT

UNIT V: **[10 Periods]**

Fuel Cells: Introduction, classification, types, conversion efficiency, applications.
Introduction to Wind-Diesel Hybrid System, Wind-Photovoltaic Hybrid System.

EMPLOYABILITY

Texts Books:

1. Non-Conventional Energy Sources by G.D. Rai, Khanna Publications.

Reference Books:

1. Non- Conventional Energy Resources by B.H. Khan by Tata Mc Graw-Hill.
2. Energy Technology Non-Conventional, Renewable & Conventional by S. Rao.
3. Future sources of electrical power by M.P. Agarwal First Edition, S. Chand & Co, 1999.

PROFESSIONAL ELECTIVE-I ANN, FUZZY SYSTEMS& GENETIC ALGORITHM	
EEE 321 (4)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Course Objectives:

The objectives of this course are to:

- Understand the fundamental theory and concepts of neural networks with different learning methods.
- Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
- Provide an emphasis on the differences and similarities between fuzzy sets and classical sets theories.
- Provide an insight into fuzzy inference applications to real time systems.
- Understand the fundamental theory and concepts of Genetic Algorithm.

Course Outcomes:

At the end of the course student should be able to:	
1.	Understand the concepts of artificial neural networks
2.	Understand various learning methods in artificial neural networks
3.	Understand the concept of fuzziness involved in various systems and fuzzy set theory
4.	Analysis the applications of fuzzy logic controllers
5.	Understand the concepts of Genetic Algorithm

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	0	0	2	2	3	0	0	0	1	0	0	0	3	0
	2	0	0	2	2	3	0	0	0	1	0	0	0	3	0
	3	0	0	2	2	3	0	0	0	1	0	0	0	3	0
	4	0	0	2	2	3	0	0	0	1	0	0	0	3	0
	5	0	0	2	2	3	0	0	0	1	0	0	0	3	0

SYLLABUS

UNIT I: **[12 Periods]**

Introduction to Artificial Neural Networks: Biological foundations, ANN models: Feed forward & Feedback Networks,Recurrent network, Types of activation functions. Network architectures: Single Layer Feed Forward Network (MLFFN) &Multi Layer Feed Forward Network (MLFFN),Characteristics of neural networks.

UNIT II: **[12 Periods]**

Learning process of Neural Networks: Learning process, Supervised and unsupervised learning, Error-correction learning, Perceptron learning, Hebbian learning, Boltzmann learning, Single layer and multilayerperceptrons: Back propagation algorithm.

UNIT III: **[12 Periods]**

Introduction to Fuzzy Logic: Crisp sets, Properties of crisp sets, Fuzzy sets, operations of fuzzy sets, properties of fuzzy sets, The cardinality of fuzzy sets, Resolution identity, Convex fuzzy sets, crisp and Fuzzy Relations, Fuzzy arithmetic, Membership functions, Fuzzy to crisp conversion, Fuzzification and defuzzificationmethods,fuzzy inference, fuzzy rule base system.

UNIT IV: **[12 Periods]**

Fuzzy Control & Applications: Fuzzy control systems, Fuzzy logic controller application to: Automatic remote control for television set, Inverted pendulum, air conditioner control, simple momentum model for air craft landing, automatic washing machine system.

UNIT V: **[12 Periods]**

Genetic Algorithm: Basic concepts, GA schema theorem, creation of offspring's,encoding(binary), fitness function, reproduction(rank selection), cross over: single and two stage, inversion & deletion, mutation.

Texts Books:

1. "Neural Network, Fuzzy Logic & Genetic Algorithm", S. Rajasekaran, G. A. VijayalakshmiPai, PHI publications, 2007.
2. "Artificial Neural Networks", bose& Liang, Tata Mcgrawhill,1996.
3. "Neural Networks: A Comprehensive Foundation", Simon Haykins, Pearson Education, Asia, 2nd edition.
4. "Fuzzy Logic with Engineering Applications", Timothy J. Ross, McGraw Hill, New York, 2nd edition.

Reference Books:

1. "An introduction to neural networks", Ben Krose& P. Vander Smagt, nov. 1996, 8th Edition.
2. "Fuzzy Set Theory and its Applications", H.J. Zimmermann, Kluwer Academic Publishers, London,3rd edition.
3. "Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications", Stamatios V Kartalopoulos, Prentice Hall of India (P) Ltd., New Delhi, 2000.

THERMO DYNAMICS & MECHANICS OF FLUIDS	
EEE 322	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

1. Engineering Physics (EEE 113)
2. Engineering Mathematics-II (EEE 121)
3. Engineering Mechanics (MEC 213)

Course Objectives:

- The course aims at instilling the basics of thermodynamics and fluid mechanics.
- It is further designed to give an overall view of internal combustion engines, Hydraulic Turbines and their performance.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Understand the physical significance of laws of thermodynamics.
2.	Apply thermodynamic principles to analyze the performance of IC engines.
3.	Comprehend the fundamentals of fluid mechanics and properties of fluids.
4.	Apply Bernoulli's equation and impulse momentum equation to practical applications.
5.	Distinguish different classes of hydraulic turbines and analyze their performance.

Mapping of course outcomes with program outcomes:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	0	0	0	0	0	1	0	3	0	0	0	0	1
	2	1	0	0	0	0	0	1	0	3	0	0	0	0	1
	3	1	0	0	0	0	0	1	0	3	0	0	0	0	1
	4	1	0	0	0	0	0	1	0	3	0	0	0	0	1
	5	1	0	0	0	0	0	1	0	3	0	0	0	0	1

SYLLABUS

UNIT I: **[12 Periods]**

Laws of Thermodynamics (statements only), Gas laws, Relation between gas constant and specific heat at constant pressure and constant volume. Thermodynamic processes of perfect gases and entropy.

UNIT II: **[12 Periods]**

I C ENGINES:Classification, Otto cycle, Diesel cycle and Dual combustion cycle-Air Standard efficiency, working of 2-stroke and 4-stroke engines. Petrol engines and Diesel engines.Power and efficiency of IC engines.

UNIT III: **[12 Periods]**

Introduction to Fluid mechanics, Fluid properties, mass density, specific weight, specific gravity, viscosity, surface tension, capillarity, compressibility & bulk modulus of elasticity, vapour pressure.

Fluid statics: Fluid pressure and its measurement, Pascal's law, Hydrostatic law, pressure distribution, Simple & Differential manometers.

UNIT IV: **[14 Periods]**

Fluid Kinematics-Types of fluid flows, Stream line, Path line, Streak line, Continuity equation, Stream function, Velocity potential function.

Fluid Dynamics: Euler's equation, Bernoulli's equation and its applications -Venturimeter, Orificemeter, Impulse-momentum equation and its applications to pipe bends, Flow through pipes, Darcy weishbach equation, Major and Minor losses in pipes.

UNIT V: **[14 Periods]**

Hydraulic machines: Impact of jets on series of stationary and moving vanes, Velocity triangles, workdone.
Turbines: Classification, Component parts and working principles of Pelton and Francis turbines hydraulic, mechanical and overall efficiency, unit quantities & specific speed.

Text Books:

1. R.S. Khurmi and J.K. Gupta, *Thermal Engineering*, S.Chand& Co publishers
2. Dr. R.K. Bansal, *Fluid Mechanics and Hydraulic machinery edition 9*Laxmi publications.

Reference Books:

1. P.N. Modi& S.M. Seth, *Hydraulics and fluid mechanics: including hydraulic machines, 2009, Standard Book House*
2. R. K. Rajput, *Thermal Engineering* 10th edition, Laxmi publication (P) Ltd.

COMPUTER ARCHITECTURE & ORGANIZATION	
EEE 323	Credits : 3
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites: Digital Logic Design (EEE 216)

Course Objectives:

- To understand the basic structure and operation of digital computer.
- To study the two types of control unit.
- To understand the different ways of communicating with I/O devices and standard I/O interfaces.
- To understand the hierarchical memory system including cache memories and virtual memory.

Course Outcomes:

At the end of the course student should be able to:	
1.	Apply the basic knowledge of the design of digital logic circuits computer organization.
2.	Acquire the knowledge on instruction codes and instruction cycle.
3.	Understand the Micro Programming Control and detail understanding of CPU.
4.	Learn and apply Input and output organization.
5.	Learn about the Memory Organization.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	0	0	2	0	0	0	0	0	2	2	0	0	0	0
	2	0	0	2	0	0	0	0	0	2	2	0	0	0	0
	3	0	0	2	0	0	0	0	0	2	2	0	0	0	0
	4	0	0	2	0	0	0	0	0	2	2	0	0	0	0
	5	0	0	2	0	0	0	0	0	2	2	0	0	0	0

SYLLABUS

UNIT I: **[12 Periods]**

Register Transfer and Micro Operations: Register Transfer Language, Register Transfer, Busand Memory Transfers, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-opeations, Arithmetic Logic Shift Unit.

UNIT II: **[15 Periods]**

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Complete Computer Description.

UNIT III: **[13 Periods]**

Micro programmed Control: Control Memory, Address Sequencing, Micro Instruction Format.

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control.

EMPLOYABILITY

EMPLOYABILITY

UNIT IV **[10 Periods]**

Input-output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access.

EMPLOYABILITY

UNIT V: **[10 Periods]**

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

EMPLOYABILITY

Text Book:

1. Computer System Architecture, M. Morris Mano, Third Edition, Pearson Education Inc.,2003

ReferenceBook:

1. Computer Systems Organization and Architecture, John D. Carpinelli, Pearson Education Inc., 2003

PERFORMANCE OF INDUCTION AND SYNCHRONOUS MACHINES	
EEE 324	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

1. Fundamentals of EEE (EEE 215)
2. Network Theory (EEE 214)
3. Electromagnetics (EEE 213)
4. Performance Electrical Machines-I (EEE 223)

Course Objectives:

At the end of the course students should understand

- Performance evolution of Induction machines
- Performance and operation of Synchronous generators
- Performance evaluation of Synchronous motors

Course Outcomes:

At the end of the course student should be able to:	
1.	Analyse the performance of three phase induction motor.
2.	Analyse the performance of single phase induction motor.
3.	Analyse the performance of three phase induction motor using circle diagram.
4.	Analyse the regulation methods and parallel operation of alternators.
5.	Develop V and inverted V curves, excitation circles and power circles of Synchronous motors.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	3	0	2	1	1	0	0	0	2	0	1	0	0
	2	1	3	0	2	1	1	0	0	0	2	0	1	0	0
	3	1	3	0	2	1	1	0	0	0	2	0	1	0	0
	4	1	3	0	2	1	1	0	0	0	2	0	1	0	0
	5	1	3	0	2	1	1	0	0	0	2	0	1	0	0

SYLLABUS

UNITI: **[14 Periods]**

Induction motor: Principle of operation of three phase induction motor, rotating magnetic field, types of rotor, torque expression, vector diagram, equivalent circuit and performance equations and calculations, slip-torque characteristic, circle diagram and performance calculations. Starting methods of induction motors, crawling and cogging, double squirrel cage induction motor, methods of speed control of induction motors, induction generator and principle of operation, self excitation of induction generator, Schrage motor, two phase motors.

SKILL DEVELOPMENT

UNIT II: **[10 Periods]**

Single phase induction motors: Types of single phase induction motor, double revolving field theory, equivalent circuit, performance analysis and characteristics of capacitor start motors, shaded pole, repulsion type, reluctance, hysteresis and ac series motors.

EMPLOYABILITY

UNIT III: **[12 Periods]**

Synchronous Generators: Basic Concepts, types of synchronous machines, construction, armature windings, emf equation, effect of chording and winding distribution, armature reaction, regulation by synchronous impedance, mmf and potier triangle methods.

SKILL DEVELOPMENT

UNIT IV: **[12 Periods]**

Synchronization: Parallel operation of synchronous generators, synchronizing current and synchronizing power. Synchronizing to infinite bus-bars and operation of infinite bus. Power transfer equations, capability curve, two reaction model of salient pole synchronous machine and power angle characteristics, determination of X_d and X_q by slip test, short circuit transients in synchronous machine.

SKILL DEVELOPMENT

UNIT V: **[12 Periods]**

Synchronous Motor: Principle of operation, methods of starting, power developed, effects of changing load at constant excitation, and changing excitation at constant load, excitation and power circles for synchronous machine, V – and inverted V – curves, hunting and damper windings.

SKILL DEVELOPMENT

Text Books:

1. D.P. Kothari, I.J. Nagarath, Electrical Machines, Tata Mac Graw Hill publication, 3rd edition, 2004.
2. Dr. P.S. Bhimbra, Electrical Machinery, Khanna publishers, 7th edtion, 2010.

Reference Books:

1. Dr. P.S. Bhimbra, Generalized theory of Electrical Machines, Khanna publishers, 4th edtion, 1987.

POWER ELECTRONICS	
EEE 325	Credits : 3
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

A basic knowledge of electronic devices and network analysis, DC and AC transients.

Course Objectives:

At the end of the course students should understand

- Operation of semiconductor devices
- Modern power semiconductor for power control
- Application of semiconductor devices for industrial oriented projects
- Design and implementation of power semiconductor devices

Course Outcomes:

This course used lectures assignments and class tests to enable the students to	
1.	Implement power electronic devices to stability, speed control, power control etc..,
2.	Design of rectifiers, inverters, cyclo converters and choppers
3.	Develop other modern power semiconductor devices

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	2	2	2	0	1	0	1	1	2	0	1	3	0
	2	1	2	2	2	0	1	0	1	1	2	0	1	3	0
	3	1	2	2	2	0	1	0	1	1	2	0	1	3	0

SYLLABUS

UNIT I: **[8 Periods]**

Thyristors: Introduction, principle of operation, two transistor model, static V-I characteristics, dynamic characteristics, gate characteristics, turn on methods, thyristor ratings, measurement of thyristor parameters, protection circuits.

SKILL DEVELOPMENT

SKILL DEVELOPMENT

UNIT II: **[12 Periods]**

Gate Triggering Circuits and Commutation Circuits: Resistance firing, resistance-capacitor firing, UJT triggering, class A, class B, class C, class D, class E, class F commutation circuits.

Series and Parallel Operation of Thyristors: Equalizing networks, string efficiency, derating.

UNIT III: **[12 Periods]**

Phase Controlled Rectifiers: Single phase -half wave, fullwave & bridge controlled rectifiers. Three phase half wave and fullwave controlled rectifiers, three phase fully controlled bridge rectifier effect of source inductance on single phase and three phase converters.

SKILL DEVELOPMENT

UNIT IV: **[12 Periods]**

Inverters: Classification, voltage source inverters, current source inverters, the Mc murray inverter, series and parallel inverters, the Mc murray–bedford inverter.

EMPLOYABILITY

UNIT V: **[16 Periods]**

Choppers: Principle of operation, stepup, stepdown choppers, two quadrant type A chopper, four quadrant chopper, Jones chopper, Morgan chopper, AC voltage controllers R, R-L loads.

Cyclo Converters: Principle of operation, single phase to single phase cyclo converter.
Principle of operation and static characteristics of diac and triac.

EMPLOYABILITY

Text Books:

1. Dr. P.S. Bimbra – Power Electronics, 4^{th} Edition, 2012, Khanna Publishers.
2. M.D. Singh, K.B. Khanchandani – Power Electronics, 2^{nd} edition, 2006,Tata Mcgraw –Hill Publishing Company Limited.

Reference Books:

1. Muhammad H Rashid – Power Electronics, Circuits, Devices & Applications,4^{th} Edition, 2003, Pearson Education.
2. Ashfeq Ahmed – Power Electronics for Technology, 1998 prentice hall Education.

POWER TRANSMISSION & DISTRIBUTION	
EEE 326	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Prerequisites:

1. Network Theory (EEE 214)
2. Electromagnetics (EEE 213)

Course Objectives:

At the end of this course the student is expected to be comfortable with the following:

- Basic Principles of Power Supply Systems.
- Various types of Distribution systems.
- Calculation of line constants
- Modeling of transmission lines
- Mechanical Design of Overhead Lines
- Different types of insulators & Cables

Course Outcomes:

At the end of the course, the student should	
1.	Able to understand various supply systems and selection of voltage, conductor size
2.	Able to understand different types of distribution systems
3.	Able to model the transmission lines and analyzes their performance
4.	Able to understand electrical and mechanical design of transmission lines

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	2	0	2	0	2	0	0	0	2	0	1	2	0
	2	1	2	0	2	0	2	0	0	0	2	0	1	2	0
	3	1	2	0	2	0	2	0	0	0	2	0	1	2	0
	4	1	2	0	2	0	2	0	0	0	2	0	1	2	0

SYLLABUS

UNIT I: **[16 Periods]**

Electric Power Supply Systems: Single line diagram of A.C power supply system, comparison between A.C and D.C systems for transmission and distribution, comparison between various supply systems, effect of system voltage on transmission, choice of working voltage for transmission, economic size of conductor – Kelvin's Law.

SKILL DEVELOPMENT

Power Distribution Systems: Classification of distribution systems, types of distributors, D.C and A.C distributor calculations with concentrated loads.

SKILL DEVELOPMENT

UNIT II: **[16 Periods]**

Transmission Line Constants: Inductance of a 1-ϕ, 2-wire line, inductance of composite conductors, concept of GMR & GMD, inductance of 3-ϕ symmetrical & unsymmetrical spaced transmission lines, transposition of power lines, inductance of double circuit 3-ϕ line, bundle conductors, skin effect & proximity effect.

Capacitance of 1-ϕ, 2-wire line, capacitance of 3-ϕ symmetrical & unsymmetrical spaced transmission lines, capacitance of double circuit 3-ϕ line, effect of earth on transmission line capacitance.

SKILL DEVELOPMENT

UNIT III: **[12 Periods]**

Performance of Transmission Lines: Short transmission lines, medium length lines, long transmission lines, surge impedance, surge impedance loading, rigorous line modeling, equivalent T & π model of a long transmission line, Ferranti effect.

SKILL DEVELOPMENT

UNIT IV: **[08 Periods]**

Mechanical Design of Transmission Lines: Sag and tension calculations, supports at equal & different levels, effect of ice and wind, stringing chart, sag template, vibration and vibration dampers, conductor materials.

EMPOLAYABILITY

Over Head Line Insulators: Types of insulators, potential distribution across the string of insulators, string efficiency, methods of equalizing the potential.

SKILL DEVELOPMENT

UNIT V: **[08 Periods]**

Underground Cables: Comparison between over head & underground systems, types of cables, construction of cables, insulation resistance of cables, grading of cables, capacitance of 3-core belted cables.

EMPLOYABILITY

Corona: Phenomenon of corona, critical voltages, power loss due to corona, factors effecting corona loss, radio interference.

Text books:

1. Soni, Gupta, Bhatnagar & Chakrabarti, 'A Text Book on Power System Engineering', Dhanpatrai & Co, Ninth Edition, 2011.
2. D.P. Kothari, I. J. Nagrath, 'Power System Engineering', Tata McGraw-Hill Publishing Company Limited, New Delhi, Second Edition, 2008.
3. C.L.Wadhwa, 'Electrical Power Systems', New Age International Publications, Sixth Edition, 2010.

Reference Books:

1. D. Das,' Electrical Power Systems', New Age International Publications, 2010.
2. J. B. Gupta, 'Transmission and Distribution of Electrical Power', S.K. Kataria & sons publications, 2009.

ELECTRICAL MACHINES LABORATORY-I	
EEE 327	**Credits : 2**
Instruction : 3 Periods /Week	**Sessional Marks : 50**
End Exam : 3 Hours	**End Exam Marks : 50**

Prerequisites: Basic knowledge of Electrical Engineering concepts

Course Objectives:

At the end of the course students should able

- To understand performance of different types of D.C machines.
- To provide a foundation in the theory and applications of D.C electrical machinery and their different types with respect to their design.
- To understand performance of single phase transformers.
- To train the students to have the solid foundation in mathematical and technical concepts required to engineering problems.

Course Outcomes:

This course used lectures assignments and class tests to enable the students to	
1.	Have knowledge of various parts of a D.C electrical machines
2.	Conduct experiments on different types of D.C machines and find the characteristics.
3.	Conduct experiments on Transformers and find the characteristics.
4.	Apply mathematical and technical concepts required to engineering problems.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	3	0	2	1	1	0	0	0	2	0	1	0	0
	2	1	3	0	2	1	1	0	0	0	2	0	1	0	0
	3	1	3	0	2	1	1	0	0	0	2	0	1	0	0
	4	1	3	0	2	1	1	0	0	0	2	0	1	0	0

SYLLABUS

SKILL DEVELOPMENT & EMPLOYABILITY

1. Swinburne's Test.
2. Load test on DC shunt motor.
3. Load test on DC series motor.
4. Speed control of DC shunt motor.
5. Speed control of DC series motor.
6. OCC & Load characteristics of DC shunt generator.
7. OCC & Load characteristics of DC separately excited shunt generator.
8. Load characteristics of DC compound generator.
9. Prediction of internal and external characteristics of a DC shunt generator.
10. Retardation Test.
11. Separation of losses in a DC machine.
12. Hopkinson's Test.
13. OC & SC tests on a 1-ϕ Transformer.
14. Sumpner's Test
15. Scott connection

THERMO DYNAMICS AND MECHANICS OF FLUIDS LABORATORY	
EEE 328	Credits : 2
Instruction : 3 Periods /Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

2017-18/282,2018-19/296,2019-20/297

Course objective:

- The Experiments are designed to develop the fundamental knowledge in thermodynamics and mechanics of fluids.
- This is attained by conducting experiments on calibration of devices like pressure gauge and flow meters and analyzing the performance of IC engines and turbo-machinery.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Calibrate pressure gauge and flow measuring devices such as venturimeter and orificemeter.
2.	Determine the properties of fuels and lubricating oils.
3.	Determine the friction factor and minor losses in pipes.
4.	Determine the force exerted by jet on vane and compare with theoretical values.
5.	Analyze the performance of IC engines and turbo-machinery.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	0	0	0	0	0	1	0	3	0	0	0	0	1
	2	1	0	0	0	0	0	1	0	3	0	0	0	0	1
	3	1	0	0	0	0	0	1	0	3	0	0	0	0	1
	4	1	0	0	0	0	0	1	0	3	0	0	0	0	1
	5	1	0	0	0	0	0	1	0	3	0	0	0	0	1

List of Experiments:

Group-A (ThermoDynamics Experiments)

1. Determination of flash and fire points of oils.
2. Determination of Viscosity using Redwood Viscometer-I&II
3. Calibration of Pressure gauge.
4. Determination of Calorific value of gaseous fuel using Junkers gas calorimeter.
5. Valve timing diagram of 4-stroke engine.
6. Port timing diagram of 2-stroke engine.
7. Load test on 4-stroke diesel engine.

Group-B (Fluid Mechanics Experiments)

1. Verification of Bernoulli's theorem.
2. Determination of coefficient of discharge through Orifice.
3. Calibration of flow meters.
   a. Venturimeter
   b. Orificemeter
4. To determine the head losses for flow through pipes and further obtain friction factor
5. Impact of jet on a
   a. Flat vane (or)
   b. Curved vane
6. To draw the performance characteristic curves for Pelton turbine.
7. To draw the performance characteristic curves for Francis turbine.

ELECTRICAL DRIVES AND TRACTION (Professional Elective-II)	
EEE 412 (1)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Course objectives

The objective of this course is to provide students with the knowledge of

- Classification and operation of electric drives.
- Characteristics of motors.
- Types of electric braking.
- General features of electric traction.

Course Outcomes

Upon successful completion of this course, students should demonstrate the ability to

CO's Number	CO's Description
CO1	Able to classify the electric drives and explain four quadrant operation in detail.
CO2	Able to modify speed torque characteristics of three phase induction motors, D.C. Motors and synchronous motors.
CO3	Able to analyse the starting & electric braking in detail employed to DC & AC Motors.
CO4	Abe to determine the Specific energy consumption for a particular run and explain the factors affecting it.

Mapping of course outcomes with program outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	1	-	-	1	2	0	2	0	1
CO2	2	3	2	2	2	1	-	-	1	2	0	2	0	2
CO3	2	3	3	2	2	1	-	-	1	2	0	2	0	2
CO4	2	3	3	2	2	1	-	-	1	2	0	2	0	2

SYLLABUS

SKILL DEVELOPMENT

UNIT-I **[10 Periods]**

ELECTRIC DRIVE: Concept and classification of electric drives, four quadrant operation, types of loads, dynamics of motor load combination, steady-state and transient stability of drive.

UNIT-II **[15 Periods]**

CHARACTERISTICS OF MOTORS: Basic relations and characteristics and modified speed torque characteristics of D.C shunt and series motors, characteristics of 3- phase induction and synchronous motors and modification of their speed – torque characteristics

SKILL DEVELOPMENT

UNIT-III **[10 Periods]**

ELECTRIC STARTING: Effect of starting on power supply, motor and load, methods of starting, acceleration time, energy relations during starting, and methods to reduce energy loss during starting.

SKILL DEVELOPMENT

UNIT-IV **[10 Periods]**

ELECTRIC BRAKING: Types of braking, braking of D.C motors during lowering of loads, braking while stopping, braking of induction and synchronous motors, energy relations during braking.

SKILL DEVELOPMENT

UNIT-V **[15 Periods]**

ELECTRICAL TRACTION: General features and systems of traction electrification, traction motors, loco wheel arrangement and riding qualities, transmission of drive, traction motor control (series-parallel control), traction equipment and collection gear, train movement, speed-time curve and speed distance curve, specific energy consumption (sec) and factors affecting it.

EMPLOYABILITY

Text Books:

1. S. K. PILLAI , “A First Course On Electric Drives”,2nd edition, 2004, wiley esastren ltd.
2. E. OPEN SHAW TAYLOR AND V.V.L. RAO ORIENTLONG man “Utilisation of electrical energy”, 2nd edition, 2004, Tata Mc Graw Hill Pub.

Reference Book:

1. H. PARTAB , “Modern Electric Traction”. 3rd edition, 2003, DHANPAT ROY & Co.
2. VEDAM SUBRAMANYAM , “ELECTRIC DRIVES” 4th edition,2006 TMH Pub.

DIGITAL CONTROL SYSTEMS (Professional Elective-II)	
EEE 412 (2)	Credits : 3
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

2018-19/301,2019-20/302

Course Objectives:

The students that successfully complete this course will be able to

- Develop discrete time models of continuous time systems.
- Develop signal-flow graphs of discrete-time systems.
- Understand State variable analysis of discrete time systems.
- Understand the effects of sampling in the performance and stability of sampled data systems.

Course Outcomes:

At the end of the course student should be able to:

CO's Number	CO's Description
CO1	Able to understand the effects of sampling in performance
CO2	Able to represent sampled data system using difference equations, transfer function, block diagram
CO3	Able to understand and design discrete control system using transform techniques
CO4	Analyze discrete time systems using signal flow graph and state space analysis
CO5	Able to understand the stability of sampled data signals

Mapping of course outcomes with program outcomes and specific outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	1	-	-	1	2	0	2	0	0
CO2	2	3	2	2	2	1	-	-	1	2	0	2	0	0
CO3	2	3	3	2	2	1	-	-	1	2	0	2	1	1
CO4	2	3	3	2	2	1	-	-	1	2	0	2	1	1
CO5	2	3	3	3	2	1	-	-	1	2	0	2	1	1

Syllabus

SKILL DEVELOPMENT

UNIT-I:

SIGNAL CONVERSION AND PROCESSING: Introduction, block diagram representation of s/h device, mathematical modelling of the sampling process, finite-pulse width sampler, folding frequency. The sampling theorem, mathematical modelling of the sampling, ideal sampler, sample and hold devices, expressions of f*(s), s-plane properties of f*(s), zero-order hold, frequency-domain characteristics of zoh, first order hold, fractional hold device.

UNIT-II:

THE Z-TRANSFORM: The Z-Transform Definition, Relationship With Laplace Transform, Alternate Expression For F(Z), Evaluation Of Z-Transform, Relationship Between S-Plane And Z-Plane, Inverse Z-Transform, Non Uniqueness Of The Z-Transform, Defining Equations Of The Inverse Z-Transform, Theorems Of The Z-Transform, Limitations Of The Z-Transform.

SKILL DEVELOPMENT

UNIT-III:

TRANSFER FUNCTION, BLOCK DIAGRAMS & SIGNAL FLOW GRAPHS: Transfer functions, block diagrams, signal flow graphs, the pulse transfer function and z-transform function, systems with cascaded elements separated by a sampler & not separated by a sampler, pulse transform function of zoh and relation between g(s) and g(z), closed loop systems, characteristic equation, physical realizability.

SKILL DEVELOPMENT

UNIT-IV:

THE STATE VARIABLE TECHNIQUES: State equations of descrete systems with sample and hold devices, state transition equations, the recursive method, the z-transform method, state equations and transfer function, characteristic equation, eigen values, eigen vectors, diagonalization of the „a‟ matrix, jordan canonical form computing state transition matrix.

SKILL DEVELOPMENT

UNIT-V:

CONTROLLABILITY, OBSERVABILITY, STABILITY: Definition of controllability, theorem on controllability, definition of observability, theorem on observability, relationships between controllability and observability and transfer function, stability of linear digital control systems, definition & theorem, stability tests, bi-linear transformation method, jury‟s stability test.

SKILL DEVELOPMENT

Text Books:

1 . Digital control systems by b.c. Kuo, second edition, saunders college publication-1992.
2 . Digital Control Systems By Ogata.
3. Digital Control Systems (Software & Hardware) By Laymount & Azzo.

DIGITAL SIGNAL PROCESSING (Professional Elective-II)	
EEE 412 (3)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

2018-19/299,2019-20/300

Course Objectives:

- To study different types of signals and properties of systems.
- To study the application of Fourier transform to discrete time systems.
- To study the FFT and inverse FFT and its applications to discrete sequences.
- To study the realization of digital filters and their design.

Course Outcomes:

By the end of the course, the student will be able to:	
CO1	Acquired knowledge on different types of signals and properties of systems..
CO2	Use Z - transforms and discrete time Fourier transforms to analyze a digital system.
CO3	Acquired knowledge on FFT for fast computation of DFT.
CO4	Ability to design and realize IIR using different techniques.
CO5	Ability to design and realize FIR using different techniques.

Mapping of course outcomes with program outcomes and specific outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	1	-	-	1	2	0	2	0	1
CO2	2	3	2	2	2	1	-	-	1	2	0	2	0	2
CO3	2	3	3	2	2	1	-	-	1	2	0	2	0	2
CO4	2	3	3	2	2	1	-	-	1	2	0	2	0	2
CO5	2	3	3	3	2	1	-	-	1	2	0	2	0	2

SYLLABUS

UNIT I **[12 periods]**

Introduction to Digital Signal Processing & Applications of Z-Transforms: Introduction to Digital Signal Processing: Discrete time signals & sequences, linear shift invariant systems, stability, and causality. Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms, Applications of Z – transforms, solution of difference equations , Block diagram representation of linear constant-coefficient difference equations.

UNIT–II: **[12 periods]**

Discrete Fourier series and Discrete Fourier Transforms: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear convolution of sequences using DFT, Computation of DFT. Relation between Z–transform and DFS.

UNIT–III: **[12 periods]**

Fast Fourier Transforms: Frequency domain representation of discrete time signals and systems – Fast Fourier transforms (FFT) – Radix–2 decimation in time and decimation in frequency FFT Algorithms – Inverse FFT – and FFT for composite N.

UNIT IV: **[12 periods]**

IIR Digital Filter Design Techniques: Introduction, Analog low pass filter design, Butterworth and Chebyshev approximations, Frequency transformations, Design of HPF, Design of IIR Digital filter from analog filters, Bilinear Transformations method, Impulse invariance method. Realization of Digital filter: Direct form-I, Direct form-II, cascade form, Parallel form.

UNIT V: **[12 periods]**

FIR Digital Filter Design Techniques: Introduction, Fourier Series method to design digital filter, Design of FIR Digital Filters using Window Techniques, Frequency Sampling technique, Comparison of IIR & FIR filters.

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006
3. Digital Signal Processing – K Raja Rajeswari, I.K. International Publishing House.

Reference Books:

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum‟s Outlines, TATA McGraw Hill, 2007.
3. DSP Primer - C. Britton Rorabaugh, Tata McGraw Hill, 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris,Thomson, 2007.

ELECTRICAL AND HYBRID VEHICLES (Professional Elective-III)	
EEE 413 (1)	**Credits: 3**
Instruction: 3 Periods & 1 Tut/Week	**Sessionals Marks:40**
End Exam: 3 Hours	**End Exam Marks:60**

Course Outcomes: At the end of the course the student will be able to:

CO1	Understand the models to describe hybrid vehicles and their performance.
CO2	Understand the different possible ways of energy storage.
CO3	Understand the different strategies related to energy storage systems.

Mapping of Course Outcomes with Program Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	0	0	0	3	3	2	0	0	0	1	0	0
CO2	2	2	2	1	3	2	2	1	0	0	0	1	0	0
CO3	2	2	2	2	3	2	2	1	0	0	0	1	0	3

UNIT-I **[10 Periods]**

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT-II **[10 Periods]**

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

SKILL DEVELOPMENT

UNIT-III **[12 Periods]**

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

SKILL DEVELOPMENT

UNIT-IV **[12 Periods]**

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

SKILL DEVELOPMENT

UNIT-V **[12 Periods]**

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

EMPLOYABILITY

Text / References:

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
3. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
4. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.

ELECTRICAL ENGINEERING DRAWING (Professional Elective-III)	
EEE 413 (2)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

SYLLABUS

UNIT: I **[12 Periods]**

Different views of different types of nuts and bolts including foundation bolts with threads. Different types of welded joints, riveted joints, keys and cotters. Different types of solid and flexible couplings Pulleys flat and V-belt drive and gears used in Electrical Machine Drive. Knifes switches: Single, Double and Triple pole types, Main Switches, Energy meters.

UNIT: II **[12 Periods]**

Pin insulators, Sackless Insulators and Disc type Insulators for L.T. and H.T. Lines. String Insulators and Guard Ring for String Insulators. Cable supports and Holders. Sketches of C.T., P.T. and other Relays with feeders and distributors.

UNIT: III **[12 Periods]**

Development of Machine Winding:D.C. pole windings. D.C. Lap winding/Single and Double layer. D.C. wave winding: Single and Double layer. Placing of carbon brushes on the commutator segments showing the direction of current.

UNIT: IV **[14 Periods]**

Free Hand Sketches: Different Industrial Electrical symbols. Pole of Machine: Different views. Armature of D.C. Machine: Different views. Commutator of D. C. Machine: Different views. D.C. Machine brush and brush holder. Single-phase Transformer. Three-phase transformer. Cross arms and their arrangement with various Insulators. Different types of poles and Towers with feeders and Distributors and Lightning Arrestors. Stay Arrangement and guard wires arrangement for roads and rail lines crossing. Battery Charging Circuit with Battery.

UNIT: V **[10 Periods]**

Earthing - different types

Text Book:

1. Electrical Engineering Drawing by G.B. Bharadwajan.
2. Electrical Engineering Drawing by Dargon.
3. Electrical Engineering Drawing by Narang.
4. Electrical Engineering Drawing by Surjit Singh.

JAVA (Professional Elective-III)	
EEE 413 (3)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	**Sessional Marks : 40**
End Exam : 3 Hours	**End Exam Marks : 60**

Pre-requisites: Object oriented concepts, C++ programming

Course Objectives:

- Be able to explain the difference between object oriented programming and procedural programming
- Its main objective is to teach the basic concepts and techniques which form the object oriented programming paradigm
- Cover issues related to the definition, creation and usage of classes, objects and methods.
- Discuss the principles of inheritance and polymorphism and demonstrate though problem analysis assignments how they relate to the design of methods, abstract classes and interfaces.

Course Outcomes:

By the end of the course, the student will be able to:	
CO1	Understand the concept of OOP as well as the purpose and usage principles of inheritance, polymorphism, and encapsulation.
CO2	Understand classes, objects, members of a class and the relationships among them needed for a specific problem.
CO3	Design and develop programs using packages and interfaces.
CO4	Develop the mechanism of exceptional handling and multithread
CO5	Implements the concept of event handling and GUI interface using Java swings

Mapping of course outcomes with program outcomes:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	3	3	3	3	3	3	3	3	0	3	2	3	2
	2	2	3	3	3	3	3	3	3	3	0	3	2	3	2
	3	3	3	0	2	3	3	3	3	3	0	3	3	2	2
	4	3	3	3	1	3	3	3	3	3	0	3	3	3	3

SYLLABUS

UNIT I: **[12 Periods]**

Introduction: OOP Principles, Encapsulation, Inheritance and Polymorphism, data types, variables, declaring variables, scope and life time of variables, arrays, operators, control statements, type conversion and casting.

UNIT II: **[12 Periods]**

Classes and Objects : Concepts of classes and objects, class fundamentals Declaring objects, introducing methods, constructors, usage of static with data and methods, access control, this key word, garbage collection, overloading methods and constructors, parameter passing – call by value, recursion..

UNIT III: **[12 Periods]**

Inheritance: Basic concepts, member access rules, usage of super key word, types of inheritance, method overriding, abstract classes, dynamic method dispatch, final keyword. **Packages and Interfaces :** Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

UNIT IV: **[12 Periods]**

Exception Handling and Multithreading : Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes, Concepts of Multithreading, differences between process and thread, thread life cycle, creating multiple threads using Thread class, Runnable interface, Synchronization, thread priorities, inter thread communication, deadlocks.

UNIT V: **[12 Periods]**

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event Applets and swings: Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets, graphics class model, handling mouse and keyboard events, Adapter classes.

Swings – JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons –The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, andTables.

Text Books:

1. The Complete Reference Java J2SE 5th Edition, Herbert Schildt, TMH Publishing Company Ltd, New Delhi.
2. “Learn Object Oriented Programming Using Java: An UML Treatment using Live Examples from Science and Engineering,” Dr. N.B. Venkateswarlu, Dr. E.V. Prasad, S Chand, New Delhi.
3. Big Java 2nd Edition, Cay Horstmann, John Wiley and Sons.

Reference Books:

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI
2. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
3. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
4. Beginning in Java 2, Iver Horton, Wrox Publications. 5. Java, Somasundaram, Jaico.

POWER SYTEM ANALYSIS	
EEE 414	**Credits: 3**
Instruction: 3 Periods & 1 Tut/Week	**Sessionals Marks:40**
End Exam: 3 Hours	**End Exam Marks:60**

2018-19/303,2019-20/304

Course Outcomes: At the end of the course the student will be able to:

CO1	Analyze power system problems using per unit systems.
CO2	Apply Gauss-Seidel, Newton-Raphson and Fast Decoupled methods to solve power flow problem.
CO3	Analyze symmetrical and unsymmetrical faults in power systems.
CO4	Understand the concept of steady state and transient stability on single machine connected to infinite bus system.

Mapping of Course Outcomes with Program Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	2	1	1	-	-	-	2	1	2	0
CO2	2	3	2	2	2	1	1	-	-	-	2	1	2	0
CO3	2	3	2	2	2	1	1	-	-	-	2	1	2	0
CO4	2	3	2	2	2	1	1	-	-	-	2	1	2	0

SYLLABUS

UNIT-I **[8 Periods]**

PER UNIT SYSTEM OF REPRESENTATION

Single line diagram, per unit system, per unit impedance of a 3-winding transformer, per unit impedance and reactance diagram of a power system.

UNIT-II **[14 Periods]**

POWER FLOW ANALYSIS

Formulation of bus admittance matrix, classification of buses, power flow problem, Gauss-Seidel Method, Newton-Raphson method, Decoupled & Fast decoupled method of solving power flow problem.

SKILL DEVELOPMENT

UNIT-III **[12 Periods]**

SYMMETRICAL FAULT ANALYSIS

Formulation of bus impedance matrix, 3-phase short circuit currents and reactances of a synchronous machine, methods of calculating symmetrical fault currents, selection of circuit-breakers, fault limiting reactors.

UNIT-IV **[12 Periods]**

UN-SYMMETRICAL FAULT ANALYSIS

Symmetrical components, 3-phase power in terms of symmetrical components, sequence impedances and sequence networks, phase shift in delta/star Transformers.

Unsymmetrical faults –L-G, L-L, L-L-G on an unloaded alternator.

SKILL DEVELOPMENT

UNIT-V **[14 Periods]**

POWER SYSTEM STABILITY

Concepts of stability (steady state and transient), swing equation, steady state stability limit, equal area criterion, critical clearing angle and time for transient stability, step by step method of solution, methods of improving transient stability.

SKILL DEVELOPMENT

TEXT BOOKS:

1. Hadi Sadat, "Power System Analysis", TMC Publications, 3rd edition, 2010.
2. John J. Grainger & William D. Stevenson, Jr.," Elements of Power System Analysis, TMH Publications, 2014.
3. I.G. Nagrath & D.P. Kothari, "Modern Power System Analysis", TMH Publications, 4th edition, 2011.

RFERENCE BOOKS:

1. B. M. Weedy & B. Cory, "Electric Power Systems", Wiley Publications, 4th edition, 2012.
2. J. Duncan Glover, M.S.Sarma & Thomas J. Overbye, " Power System Analysis &Design Systems", CLI Private Ltd.,2012.

POWER SEMICONDUCTOR DRIVES	
EEE 415	**Credits: 3**
Instruction: 3 Periods & 1 Tut/Week	**Sessionals Marks:40**
End Exam: 3 Hours	**End Exam Marks:60**

Course Outcomes: At the end of the course the student will be able to:

2018-19/304,2019-20/305

Mapping of Course Outcomes with Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2	2	1	-	-	2	2	2	2	0	2
CO2	3	3	3	3	2	1	-	-	2	2	2	2	0	2
CO3	3	3	3	3	2	1	-	-	2	2	2	2	0	2
CO4	3	3	3	3	2	1	-	-	2	2	2	2	0	2
CO5	3	3	3	3	2	1	-	-	2	2	2	2	0	2

SYLLABUS

UNIT I: **[14 Periods]**

Control of DC motors by Single phase and three phase Converters: Introduction to Thyristor controlled Drives, Single Phase semi and Fully controlled converters connected to d.c separately excited and d.c series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on Converter fed d.c motors.Three phase semi and fully controlled converters connected to d.c separately excited and d.c series motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems.

EMPLOYABILITY

UNIT II: **[08 Periods]**

Four Quadrant operation of DC Drives: Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic and Regenerative Braking operations. Four quadrant operation of D.C motors by dual converters.

UNIT III: **[10 Periods]**

Control of DC motors by Choppers: Single quadrant, Two –quadrant and four quadrant chopper fed dc separately excited and series excited motors – Continuous current operation – Output voltage and current wave forms – Speed torque expressions – speed torque characteristics – Problems on Chopper fed d.c Motors .

SKIILL DEVELOPMENT

UNIT IV: **[16 Periods]**

Control of Induction Motor through Stator voltage: Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers – Waveforms – speed torque characteristics. Variable frequency characteristics-Variable frequency control of induction motor by Voltage source and current source inverter and cyclo converters- PWM control – Comparison of VSI and CSI operations – Speed torque characteristics ,Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – their performance and speed torque characteristics – advantages applications .

SKIILL DEVELOPMENT

UNIT V: **[12 Periods]**

Control of Synchronous Motors: Separate control & self control of synchronous motors – Operation of self controlled synchronous motors by VSI, CSI and cyclo converters. Load commutated CSI fed Synchronous Motor – Operation – Waveforms – speed torque characteristics – Applications – Advantages and Numerical Problems.

TEXT BOOKS:

1. Fundamentals of Electric Drives – by G K Dubey Narosa Publications
2. Power Electronic Circuits, Devices and applications by M.H.Rashid, PHI.

REFERENCE BOOKS:

1. Power Electronics – MD Singh and K B Khanchandani, Tata – McGraw-Hill Publishing company,1998.
2. Modern Power Electronics and AC Drives by B.K.Bose, PHI.
3. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publilcations.
4. A First course on Electrical Drives – S K Pillai New Age International(P) Ltd. 2nd Editon.

POWER SYTEM PROTECTION	
EEE 416	**Credits: 3**
Instruction: 3 Periods & 1 Tut/Week	**Sessionals Marks:40**
End Exam: 3 Hours	**End Exam Marks:60**

Course Outcomes: At the end of the course the student will be able to:

CO1	Understand the construction, operation and applications of electromagnetic relays.
CO2	Understand the construction, operation and applications of static and numerical relays.
CO3	Analyze the effect of over voltages on power system.
CO4	Analyze quenching mechanisms used in air, oil, vacuum and SF_6 circuit breakers and draw the substation layouts.

Mapping of Course Outcomes with Program Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	2	1	1	-	1	1	2	1	2	0
CO2	2	3	2	2	2	1	1	-	1	1	2	1	2	0
CO3	2	1	1	1	1	1	1	-	1	1	2	1	2	0
CO4	2	3	2	2	1	1	1	-	1	1	2	1	2	0

SYLLABUS

UNIT-I **[15 Periods]**

PROTECTIVE RELAYING

Faults, causes and effects, Importance of protective relaying, Evolution of protective relays, Protective zones, Primary and backup protection, Desirable qualities of protective relaying, classification of protective relays and schemes, current transformers, potential transformers, basic relay terminology. Operating principle and construction of electromagnetic relays.

Over Current and Earth Fault Protection- Applications of over current protection, relays used in over current protection, time current characteristics, directional relays, protection of parallel feeders, and protection of ring mains. Phase fault and earth fault protection, combined earth fault and phase fault protective scheme, Directional earth fault relay.

UNIT-II **[10 Periods]**

DISTANCE AND DIFFERENTIAL PROTECTION:

Distance Protection - Principle of operation of distance protection, R-X diagram, universal torque equation, impedance, reactance and mho relay. Zones of protection, auto reclosing. Pilot wire protection and carrier current protection.

Differential Protection -Types, protection of generators, protection of transformers, and bus-zone protection.

UNIT-III **[10 Periods]**

STATIC AND NUMERICAL RELAYS

Block diagram representation, Merits and demerits of static relays, amplitude and phase comparators, basic block diagrams of static over current, distance and differential protection. Block diagram of microprocessor based relay, advantages.

EMPLOYABILITY

UNIT-IV **[10 Periods]**

PROTECTION AGAINST OVER VOLTAGES

Causes of over voltages, over voltages due to lightning. Protection against lightning and travelling waves – earth wire, effects of series inductances, shunt capacitance, spark gap, surge arresters, lightning arresters, insulation co-ordination.

SKILL DEVELOPMENT

UNIT-V **[15 Periods]**

CIRCUIT BREAKERS AND SUBSTATION LAYOUT

Fuses-Types of fuses, high voltage HRC fuses, applications, selection and discrimination.

Circuit Breakers-Principle of operation, formation of arc, methods of arc extinction, transient recovery voltage, resistance switching, switching of capacitor banks and un-loaded lines, current chopping, ratings and characteristics of circuit breakers. Classification, constructional features of air circuit breakers, oil circuit breakers, air blast circuit breakers, SF-6 circuit breakers and vacuum circuit breakers, testing of circuit breakers.

EMPLOYABILITY

SUB-STATION LAYOUT & BUS BARS: Classification of substations, substation equipment and their function, bus-bar design and schemes of layout.

EMPLOYABILITY

TEXT BOOKS:

1. Sunil S. Rao, “Switchgear Protection and Power Systems” Khanna Publishers, 13th, edition, 2013,
2. B. Ram and D.N. Viswakarma, “Power System protection and Switchgear” TMH Publications, 2nd, edition, 2013.

REFERENCE BOOKS:

1. C.L. Wadhwa, “Electrical power Systems”, New Age International Publishers, 6th edition, 2010.
2. L. P. Singh, “Protective relaying from Electromechanical to Microprocessors”, New Age International Publishers, 2nd edition, 2004.

POWER ELECTRONICS LABORATORY	
EEE 417	**Credits:2**
Instruction: 3 Periods	**Sessionals Marks:50**
End Exam: 3 Hours	**End Exam Marks:50**

Course Outcomes:
At the end of the course student should be able to:

CO's Number	CO's Description
CO1	Able to convert fixed DC to variable AC , variable AC to fixed DC, fixed DC to variable DC by conducting suitable experiment using power semiconductor devices
CO2	Able to control magnitude and frequency of supply voltage(1-phase supply) and thereby control the speed of 1-phase induction motor by conducting suitable experiment using power semiconductor devices.
CO3	Able to turn on and turn off SCR by conducting suitable experiment.
CO4	Able to obtain static vi characteristics of SCR by conducting suitable experiment

Mapping of course outcomes with program outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	3	1	1	-	1	1	2	1	0	2
CO2	2	3	3	3	3	1	1	-	1	1	2	1	0	2
CO3	2	3	3	3	3	1	1	-	1	1	2	1	0	2
CO4	3	3	3	3	2	1	-	-	2	2	2	2	0	2
CO5	3	3	3	3	2	1	-	-	2	2	2	2	0	2

LIST OF EXPERIMENTS:

1. V-I characteristics of SCR.
2. SCR firing circuits (R, RC and UJT).
3. Forced commutation techniques.
4. Single-phase semi and full converters.
5. Three-phase semi-converter.
6. Single-phase AC voltage controller
7. Single-phase cyclo converter.
8. Jones Choppers.
9. Series converter.
10. Parallel converter.
11. Dual converter.

SKILL DEVELOPMENT & EMPLOYABILITY

ELECTRICAL MACHINES LABORATORY - II	
EEE 418	**Credits:2**
Instruction: 3 Periods	**Sessionals Marks:50**
End Exam: 3 Hours	**End Exam Marks:50**

Course Objectives:

At the end of the course student should understand

- Regulation of Alternator by EMF ,MMF and ZPF methods
- Measurement of Xd and Xq of alternator
- Various Methods of speed control of 3phase slip ring induction motor
- Performance characteristics of 3phase induction motor

Course Outcomes:

At the end of the course student should be able to:

CO's Number	CO's Description
CO1	Able to analyze the transformer for 3 phase to 2 phase or 2 phase to 3 phase conversion and also separate the losses
CO2	Able to analyze the speed control and performance characteristics of 3 phase induction machine
CO3	Able to analyze the voltage regulation and performance characteristics of 3 phase synchronous machine

Mapping of course outcomes with program outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	1	1	-	-	3	-	-	-	2	0
CO2	2	3	3	3	2	2	-	-	3	1	-	-	0	2
CO3	2	3	3	3	2	2	-	-	3	1	-	-	2	0

List of experiments:

1. Verification of Scott connection.
2. Load test on a 3-ϕ Induction motor.
3. No load and Block rotor tests on 3-ϕ Induction motor.
4. Speed control of 3-ϕ Slip-ring Induction motor.
5. Regulation of an alternator by EMF and MMF methods.
6. Regulation of an alternator by ZPF method.
7. „V" and „Inverted V" Curves of Synchronous motor.
8. Slip test on Salient pole Synchronous machine.
9. 3-ϕ Induction motor runs as a 1-ϕ Induction motor.
10. Sumpner"s Test on Three identical 1-ϕ Transformers connected in Δ/Δ.
11. R-L-C Load Test on a 1-ϕ Transformer.
12. Equivalent circuit of a 1-ϕ Induction motor.
13. Line-excited Induction generator
14. Separation of losses in single phase transformer

SKILL DEVELOPMENT & EMPLOYABILITY

INDUSTRIAL TRAINING	
EEE 419	**Credits: 2**
Instruction: ---	**Sessionals Marks:100**

PROJECT WORK	
EEE 4110	**Credits: 4**
Instruction: 6 Periods / Week	**Sessionals Marks:60**
End Exam: ---	**End Exam Marks:60**

ENGINEERING ECONOMICS AND MANAGEMENT	
EEE 421	**Credits: 3**
Instruction: 3 Periods & 1 Tut/Week	**Sessionals Marks:40**
End Exam: 3 Hours	**End Exam Marks:60**

2018-19/310,2019-20/311

Course Objectives:

- To familiarize the students with the concepts of Economics.
- To gain basic understanding of management and manage organizations effectively and to relate the concepts of management with industrial organizations
- To help the students to understand the factors affecting productivity and to acquaint them with the major aspects of production management
- To make them to know the basics of Accounting, entrepreneurship and marketing management.

Course Outcomes: At the end of the course the student will be able to:

CO1	Understand the concepts of Economics
CO2	Gain basic understanding of management and to relate the concepts of management with industrial organizations and manage organizations efficiently
CO3	Have the basic knowledge of production management and make decisions proficiently
CO4	Understand the basic concepts of accounting, finance and marketing management

Mapping of Course Outcomes with Program Outcomes:

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	0	0	0	0	0	0	0	2	0	3	2	0	0
CO2	0	0	0	0	0	0	0	0	2	0	3	2	0	0
CO3	0	0	0	0	0	0	0	0	2	0	3	2	0	0
CO4	0	0	0	0	0	0	0	0	2	0	3	2	0	0

Correlation levels 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS

UNIT I: Fundamentals of Economics: [10 Periods]

Wealth, Welfare and Scarce Definitions of Economics; Micro and Macro Economics; Demand- Law of Demand, Elasticity of Demand, Types of Elasticity and Factors determining price elasticity of Demand: Utility- Law of Diminishing Marginal Utility, its limitations and exceptions. [**CO 1]**

UNIT II: Forms of Business Organizations: [10 Periods]

Features, merits and demerits of Sole Proprietorship, Partnership and Joint Stock Company- Public Enterprises and their types. **(CO 2)**

UNIT III: Introduction to Management: [20 Periods]

Functions of Management- Taylor‟s Scientific Management; Henry Fayol‟s Principles of Management; **Human Resource Management** –Basic functions of Human Resource Management (in brief). **(CO 2)** **Production Management:** Production Planning and Control, Plant Location, Break-Even Analysis-Assumptions, limitations and applications. **(CO 3)**

UNIT IV: Financial Management: [10 Periods]

Types of Capital: Fixed and Working Capital and Methods of Raining Finance; Final Accounts- Trading Account, Statement of Profit and Loss and Balance Sheet (simple problems) **(CO 4)**

UNIT V: Marketing Management and Entrepreneurship: [10 Periods]

Marketing Management: Functions of marketing and Distribution Channels. **Entrepreneurship**: Definition, Characteristics and Functions of an Entrepreneur. **(CO 4)**

Text Books:

1. S.C. Sharma and Banga T. R., Industrial Organization & Engineering Economics, khanna Publications, Delhi-6. (2006) **(Units covered – 3,4 and 6)**

2. A.R. AryaSri, Managerial Economics and Financial Analysis, TMH Publications, new Delhi, (2014) **(Units covered – 1,2,4 and 5)**

3. S.N.Maheswari, SK Maheswari, Financial Accounting Fifth Edition, Vikas Publishing HousePvt. Ltd., New Delhi, (2012) **(Units covered – 5)**

NON-LINEAR SYSTEMS PROFESSIONAL ELECTIVE-IV	
EEE 422 (1)	**Credits: 3**
Instruction: 3 Periods & 1 Tut/Week	**Sessionals Marks:40**
End Exam: 3 Hours	**End Exam Marks:60**

SYLLABUS

UNIT-I:

Introduction to Non-Linear System: Classification of non-linearity, types of non-linearity in physical system, jump phenomena and critical jump resonance curve, methods of analysis of non-linear systems and comparison, isoclines, singular point, limit cycle.

UNIT-II:

Phase Plane Analysis: Concept of phase plane, phase trajectory, phase portraits, methods of plotting phase plane trajectories Vander Pol"s equation, stability from phase portrait, time response from trajectories, isoclines method, Pell's method of phase trajectory, and Delta method of phase trajectory construction.

SKILL DEVELOPMENT

UNIT-III:

Frequency Domain Analysis: Absolute stability, Describing function, DF of typical nonlinearities stability analysis using DF method, stability studies using DF method.

SKILL DEVELOPMENT

UNIT-IV:

Liapunov Stability: Autonomous Systems: Stability of equilibrium point. Concepts of positive definite/semi definite, negative definite/ semi definite, indefinite functions, Lyapunov function, Liapunov Stability: asymptotic stability, global asymptotic stability, instability.

UNIT-V:

Linearization: Linear systems, linearization of nonlinear systems, input state linearization about equilibrium point, feedback linearization and input/output linearization.

SKILL DEVELOPMENT

TEXT BOOK:

1. M.Vidyasagar, 'Nonlinear systems Analysis', 2nd Edition, 1991, prentice-Hall Inc.
2. Nonlinear Systems: Hassan K. Khalil, Prentice Hall of India, second edition.
3. Nonlinear Control Systems: Hassan K. Khalil, Prentice Hall of India.

REFERENCE BOOK:

1. Control System Engineering: Nagrath and Gopal, Wiley Eastern.
2. Applied Nonlinear Control: Jean Jacques E Slotine, Weiping Li
3. Automatic Control System: George J. Thaler Brown, Jaico Publications

POWER SYSTEM RELIABILITY 2018-19/312,2019-20/313 PROFESSIONAL ELECTIVE-IV	
EEE 422 (2)	**Credits: 3**
Instruction: 3 Periods & 1 Tut/Week	**Sessionals Marks:40**
End Exam: 3 Hours	**End Exam Marks:60**

Course Outcomes: At the end of the course the student will be able to:

CO1	Understand the importance of maintaining reliability of power system components.
CO2	Apply the probabilistic methods for evaluating the reliability of generation and transmission systems.
CO3	Assess the different models of system components in reliability studies.
CO4	Assess the reliability of single area and multi area systems.

Mapping of Course Outcomes with Program Outcomes

CO's No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	1	2	1	1	0	2	1	0	1
CO2	2	2	2	2	2	1	2	2	2	0	2	1	0	1
CO3	2	2	2	2	2	1	2	2	2	0	2	1	0	1
CO4	2	2	2	2	2	1	2	2	2	0	2	1	0	1

SYLLABUS

UNIT-I **[12 Periods]**

BASIC REIABILITY CONCEPTS

The general reliability function, the exponential distribution – mean time to failures – series and parallel systems, markov process – continuous Markov process – Recursive techniques –Simple series and parallel system models.

SKILL DEVELOPMENT

UNIT-II **[12 Periods]**

GENERATING CAPACITY – BASIC PROBABILITY METHODS

The generation system model – Loss of load indices – Capacity expansion analysis – scheduled outages. Load forecast uncertainty Loss of energy indices, the frequency and duration method.

TRANSMISSION SYSTEMS RELIABILITY EVALUATION

Radial configuration, conditional probability approach, network configurations, state selection.

SKILL DEVELOPMENT

UNIT-III **[12 Periods]**

GENERATION PLANNING

Comparative economic assessment of individual generation projects, investigation and simulation models, heuristic and linear programming models, probabilistic generator and load models.

SKILL DEVELOPMENT

UNIT-IV **[12 Periods]**

TRANSMISSION PLANNING

Deterministic contingency analysis, probabilistic transmission system–reliability analysis, reliability calculations for single area and multi–area power systems.

EMPLOYABILITY

UNIT-V **[12 Periods]**

DISTRIBUTION PLANNING

Network configuration design-consisting of schemes, security criteria configuration synthesis.

SKILL DEVELOPMENT

Text Books:

1. Roy Billinton and Ronald N Allan, "Reliability Evaluation of Power Systems", PPC, 2nd Edition, 1996.
2. V. Sankar, "System Reliability Concepts",Himalaya Publishing House, 2015.
3. R.L. Sullivan, "Power System Planning", McGraw Hill International, 1977.
4. Wheel Wright and Makridakis, "Forecasting methods and Applications", John Wiley, 1992.
5. J. Endremyl, "Reliability Modelling in Electric Power Systems", John Wiley, 2005.

DESIGN OF ELECTRICAL MACHINES PROFESSIONAL ELECTIVE-IV	
EEE 422 (3)	**Credits: 3**
Instruction: 3 Periods & 1 Tut/Week	**Sessionals Marks:40**
End Exam: 3 Hours	**End Exam Marks:60**

Course Objectives:

At the end of the course students should understand

- D.C machines designing part
- Design of transformers
- Design of Induction motors
- Design of Synchronous machines

Contribution to Outcomes:

This course used lectures assignments and class tests to enable the students to

CO1	Design of Armature winding ,field winding & Armature slots.
CO2	Design the core dimensions and windings of Three phase and single phase Transformers.
CO3	Design the main dimensions, rotor & stator slots and air gap length of Induction and synchronous machines.

SYLLABUS

UNIT I: **[10 Periods]**

Rating and Heating of Motors:

Heating effects, loading conditions and classes of duty, determination of power ratings of motors for different applications, effect of load inertia, load equalization and fly wheel, calculations, environmental factors.

UNIT II: **[15 Periods]**

D.C.MACHINES:

E.M.F generated from full pitch - fractional pitch with and without distributed windings - distribution factor. Design of main dimensions from output equation - Design of Armature windings - Design of field system - Design of inter pole and commutator.

SKILL DEVELOPMENT

UNIT III: **[10 Periods]**

TRANSFORMERS:

Derivation of output equation - volt per turn importance and calculation of main dimensions for three phase and single phase transformers - window dimensions – Yoke design and coil design - Design of tank with tubes.

SKILL DEVELOPMENT

UNIT IV: **[13 Periods]**

INDUCTION MOTOR:

Derivation of output equation - calculation of main dimensions – Stator design - number of slots - shape and area of slots - Rotor design for squirrel cage and slip ring types.

SKILL DEVELOPMENT

UNIT V: **[12 Periods]**

SYNCHRONOUS MACHINES:

Derivation of output equation - Calculations of Main Dimensions for salient pole and cylindrical rotor alternators - Stator design - number of stator slots and slot dimensions - Pole design for salient pole generators - pole winding calculations. Design of rotor for cylindrical rotor alternator - Design of rotor windings.

SKILL DEVELOPMENT

TEXT BOOKS:

1. A.K. Sawhney, A Course in Electrical machine Design, Dhanpatrai & Sons,
2. M.G. Say,Performance and Design of AC Machines 3rd Edition.
3. A.E. clayton, Performance and Design of AC Machines 2004.

ENERGY MANAGEMENT & CONTROL	
EEE 423	**Credits: 3**
Instruction: 3 Periods & 1 Tut/Week	**Sessionals Marks:40**
End Exam: 3 Hours	**End Exam Marks:60**

Course Outcomes: At the end of the course the student will be able to:

CO1	Understand various aspects of economic operation.
CO2	Analyze the load frequency mechanism.
CO3	Analyze the voltage control mechanism.
CO4	Understand the emergency control actions.
CO5	Understand the importance of energy auditing.

Mapping of Course Outcomes with Program Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	2	1	1	1	1	1	2	1	2	0
CO2	2	3	2	2	2	1	1	1	1	1	2	1	2	0
CO3	2	3	2	2	2	1	1	1	1	1	2	1	2	0
CO4	2	3	2	2	2	1	1	1	1	1	1	1	2	0
CO5	2	3	2	2	2	1	1	1	1	1	2	1	2	0

SYLLABUS

UNIT-I **[12 Periods]**

ECONOMIC OPERATION OF POWER SYSTEMS

Various aspects of economic operation, characteristics of steam, cogeneration and hydroelectric units, economic dispatch problem of thermal units with and without considering transmission losses using Lambda–iteration method, derivation of transmission loss formula, coordination equation, penalty factors, unit commitment problem and solution using Lagrange relaxation method, economic dispatch versus unit commitment, hydrothermal coordination problem and solution using Lagrange relaxation method, optimal load flow problem.

SKILL DEVELOPMENT

UNIT-II **[12 Periods]**

REAL POWER AND FREQUENCY CONTROL

Basic generator control loops, importance of frequency control, load-frequency control model, automatic generation control, automatic generation control in single and two-area systems, automatic generation control with economic dispatch control, speed governor dead-band and its effect on automatic generation control.

SKILL DEVELOPMENT

UNIT-III **[12 Periods]**

REACTIVE POWER AND VOLTAGE CONTROL

Reactive power flow, methods of voltage control-injection of reactive power by using shunt capacitors, series capacitors, synchronous compensators, tap-changing transformers, booster transformers and phase-shift transformers, types of excitation system, block diagram of automatic voltage regulator, automatic voltage regulator model,

SKILL DEVELOPMENT

UNIT-IV **[12 Periods]**

EMERGENCY CONTROL

Energy control center – various levels – national, regional and state level – SCADA system – computer configuration – function – monitoring, data acquisition and controls – EMS system, Power system operating states and control actions, power system security, power system state estimation-static and dynamic.

SKILL DEVELOPMENT

UNIT-V **[12 Periods]**

ENERGY AUDITING

Energy management system model, definition of energy audit, contents of energy audit, energy audit laws and regulations, key reasons for energy audit, energy diagnosis methods, energy diagnosis of power distribution systems, lighting systems, compressed air system, air condition and ventilation system, case study.

EMPLOYABILITY

Text Books:

1. Hadi Sadat, "Power System Analysis", TMC Publications, 3rd edition, 2010.
2. B. M. Weedy & B. Cory, "Electric Power Systems", Wiley Publications, 4th edition, 2012.
3. O.I.Elgerd "Electric Energy Systems Theory-An Introduction", TMH edition, 2nd edition, 2012.
4. I.G. Nagrath & D.P. Kothari, "Modern Power System Analysis", TMH Publications, 4th Edition, 2011.

Reference books:

1. L.P. Singh, “Advanced Power System Analysis and Dynamics”, New Academic Science Ltd., 6th edition, 2011.
2. Mahalanabis A. K., Kothari D.P. and Ahson S.I., “Computer Aided Power System Analysis and Control, TMH Publications, 1999.
3. BSR Energy Management Hand Book (e-book).
4. Amit Kumar Tyagi, “Energy Audit and Management”, Tata Energy Rersearch Institute (TERI), 2001.
5. Paul W. Callghan, “Energy Management and a comprehensive Guide”.

POWER SYSTEM SIMULATION LABORATORY	
EEE 424	**Credits: 2**
Instruction: 3 Periods	**Sessionals Marks:50**
End Exam: 3 Hours	**End Exam Marks:50**

2018-19/315,2019-20/316

Course objectives

At the end of this lab course, the student is able to

- Calculate various symmetrical and unsymmetrical fault currents.
- Find the string efficiency of suspension insulators.
- Understand the performance of the transmission lines.
- Understand AGC operation
- Simulate economic dispatch problem.

Course Outcomes

Upon successful completion of this course, the student is able to

- Simulate various symmetrical and unsymmetrical fault currents.
- Simulate the performance of the transmission lines.
- Simulate AGC of single and two area systems.
- Simulate economic dispatch problem with and without considering losses.

Mapping of program outcomes with CO's:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	3	1	-	-	1	1	2	1	2	0
CO2	2	3	3	3	3	1	1	1	1	1	2	1	2	0
CO3	2	3	3	3	3	1	1	1	1	1	2	1	2	0
CO4	2	3	3	3	3	1	1	1	1	1	2	1	2	0

List of Experiments:

1. MATLAB SIMULINK model to simulate single - area and Two - area Load Frequency control (a) Without PI Controller (b) with PI Controller.
2. Load flow analysis using ETAP.
3. Short circuit analysis of a simple power system using ETAP. (a) Balanced Faults (b) Unbalanced Faults
4. Measurement of sequence impedances of a synchronous generator.
5. Optimal Operation of thermal units using MATLAB. (a) Without considering losses (b) With losses
6. String efficiency of suspension insulators using MATLAB.
7. Transmission line performance using MATLAB.
8. Y-Bus matrix formation using MATLAB

SKILL DEVELOPMENT & EMPLOYABILITY

CONTROL SYSTEMS LABORATORY	
EEE 425	**Credits: 2**
Instruction: 3 Periods	**Sessionals Marks:50**
End Exam: 3 Hours	**End Exam Marks:50**

Course objectives:

At the end of the lab course student should understand:

- The mathematical modeling of ac and dc servomotors.
- The analysis of synchro pair (Error detector).
- The response of 1st, 2nd and 3rd order systems with and without feedback.
- Design of compensators (lag, lead and lag-lead)

Course Outcomes:

At the end of the lab course student should understand:

- the mathematical modeling of ac and dc servomotors.
- the analysis of synchro pair (error detector).
- the response of 1st,2nd and 3rd order systems with and without feedback.
- Design of compensators (lag, lead and lag-lead)

Mapping of program outcomes with CO's:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2	2	1	-	-	2	2	-	1	0	1
CO2	2	3	3	2	2	1	-	-	2	2	-	1	0	1
CO3	2	3	3	2	2	1	-	-	2	2	-	1	0	1
CO4	2	3	3	3	3	1	-	-	2	2	-	1	0	1
CO5	2	3	3	3	3	1	-	-	2	2	-	1	0	1

List of Experiments:

- Characteristics of magnetic amplifier
- Digital control systems (microprocessor based)
- Digital control systems (pc interface)
- Synchro pair
- Characteristics of ac servo motor
- Characteristics of dc servo motor
- Temperature controller(thermal system)
- Linear system simulator
- Speed-Torque characteristics of dc motor(closed loop)

SKILL DEVELOPMENT & EMPLOYABILITY

PROJECT WORK	
EEE 426	Credits: 8
Instruction: 6 Periods / Week	Sessionals Marks:60
End Exam: ---	End Exam Marks:140

ADVANCED ENGINEERING DRAWING

Course Code - Category: MEC 123 - ES **Credits: 3**

L	T	P	E	O
2	0	2	2	4

Sessional Marks:50

End Exam: 3 Hours

End Exam Marks:50

Course Objectives:

The course is intended to familiarize the student with basics of CAD software and apply it for generating 2D and 3D drawings. Further draw by conventional methods and using software the projections of sectioned solids, intersections of solids and develop surfaces of primitives.

Course Outcomes:

By end of the course, the student will be able to:	
CO1	Apply CAD software for drafting simple 2D drawings with dimensions
CO2	Generate 3D solid models using CAD software
CO3	Draw orthographic projections for sections of solids and develop surfaces of regular and truncated solids by conventional method and CAD software
CO4	Draw orthographic projections for intersections of prisms, cylinders, and cones by conventional method and CAD software
CO5	Draw isometric projections from orthographic projections and vice-versa by conventional method and CAD software

Skill development/Empolability

UNIT-I

Computer Aided Drafting:

Introduction, Applications, CAD software- AutoCAD, GUI, function keys, Drawing entities, Drafting aids(limits, layers, dimensioning, object snap, zoom), modify commands, Block, WBlock and insert, Two Dimensional drawings-exercises. List of commands

Skill development/Employability

UNIT-II

Isometric Drawings & 3D Modeling:

Setting Isometric mode, Isoplanes, isometric commands. 3D geometrical modeling- 3D wire frame modeling, 3D surface modeling and 3D solid modeling. 3D solid modeling: UCS, Standard 3D shape based solids, Profile based solids. Commands to generate profile based 3D solids- simple exercises.

UNIT-III

Sections and Development: section plane: auxiliary inclined plane, auxiliary vertical planes. Sections of prisms, pyramids, cone, cylinder in simple positions and true shape of sections. Development of prisms, pyramids, cone, cylinder. Exercises shall be by using both conventional drawing and Auto CAD 3D solid models.

Skill development

Skill development

UNIT-IV

Intersection of surfaces: Intersection of square prisms face equally inclined to principle planes with their axis perpendicular(axis intersecting and offset), intersection of cylinders with their axis perpendicular(axis intersecting and offset), intersection of cone and cylinder with their axis perpendicular and intersecting. Exercises shall be by using both conventional drawing and Auto CAD 3D solid models.

Skill development/Employability

UNIT-V

Isometric Projections: Isometric projections, conversion of orthographic projection into isometric projection and vice-versa of simple machine parts. Exercises shall be by using both conventional drawing and Auto CAD isoplanes.

TEXT BOOK:

1. **N. D. Bhatt** *" Engineering Drawing"* 53rd Edition Charotar Publishing House Pvt. Ltd,: 2014

REFERENCE BOOKS:

1. **K. L. Narayana& P. Kanniah** *"Engineering Drawing"*
2. **R. B. Choudary "***Engineering Graphics with Auto CAD"*
3. **TrymbakaMurty** *"Computer Aided Engineering Drawing"*

BASIC ELECTRONICS ENGINEERING

Course Code - Category: MEC 124 - ES **Credits:3**

L	T	P	E	O
3	0	0	1	3

Sessional Marks:40

End Exam: 3 Hours

End Exam Marks:60

Prerequisites: Nil

COURSE OBJECTIVES:

This course is designed to introduce the principles of semiconductor devices, digital electronic circuits and instrumentation which enable the basic understanding of the operation of circuits containing diodes and transistors. In addition, basic logic circuits and instruments like DVM, DMM and CRO are introduced.

COURSE OUTCOMES:

After completion of the course the student will be able to	
CO1	Understand the behavior of PN diode under different biasing conditions and use zener diode as shunt regulator
CO2	Calculate the efficiency and ripple factor of half wave, Full wave center tapped and Bridge rectifiers
CO3	Obtain input and output characteristics of BJT in different configurations and identify the region of operation of transistor
CO4	Perform number conversions between different number systems and implement the Boolean functions simplified using Boolean algebra with basic gates and universal gates
CO5	Apply the knowledge of cathode ray oscilloscopes and understand the functioning, specification, applications of signal analyzing instruments

SYLLABUS

UNIT-I: SEMICONDUCTOR DIODES **9 periods**

Intrinsic semiconductors, Doped semiconductors, drift current, Diffusion current, Einstein relationship, PN Junction: Physical structure, operation with open –circuit terminals. PN Junction with an applied voltage, the ideal diode: current voltage characteristics, Forward bias region, reverse bias region, breakdown region. Zener diode as a shunt regulator, LEDs.

UNIT-II: RECTIFIERS **9 periods**

Half wave rectifier, Full wave center tapped and Bridge rectifiers, Rectifier- DC components, AC Components, Ripple factor, Transformer Utilization factor, Efficiency, PIV, and Regulation.

UNIT-III: BJT CHARACTERISTICS 9 periods

Simplified structure and modes of operation, Active region, Saturation region, Cutoff region, circuit symbols and conventions, Transistor current components, Input and Output Characteristics of transistor in Common Base, Common Emitter, Common Collector Configurations, Punch through effect, BJT as an amplifier and as a switch.

UNIT-IV: DIGITAL LOGIC GATES 9 periods

Number systems used in digital electronics: Decimal number system and Binary number system and their conversion, binary operations, use of complements, Hexadecimal number systems, Boolean algebra, Logic gates, realization of basic gates using NAND/NOR, SOP, POS, Implementation of logic expressions using logic gates.

UNIT-V: ELECTRONICS INSTRUMENTS 9 periods

Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments. DVM, DMM, CRO: Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Applications of CRO - Voltage, Current and frequency measurements.

TEXT BOOKS:

1. **Sanjeev Gupta** "*Electronic Devices and Circuits*" Dhanpat Rai Publications, 2010.
2. **Jacob Millman, Christos halkias, Chetan D Prakash** "*Millman's Integrated Electronics*" Tata McGraw-Hill, 2012

REFERENCE BOOKS:

1. **K Venkata Rao, K Rama Sudha** "*Electronic Devices and Circuits*"McGraw Hill Education 2015
2. **David A Bell** "*Electronic Devices and Circuits*" - Oxford
3. **S Salivahanan, N Suresh Kumar, A Vallav Raj** "Eclectronic Devices and Circuits" Tata McGraw-Hill
4. **Jacob Millman, Arvin Grabel** "*Micro Electronics*"Tata McGraw-Hill

II YEAR – I SEMESTER

ENGINEERING MATHEMATICS-III

(COMMON TO EEE, ECE , CHEMICAL , CIVIL & MECHANICAL)

Course Code: MEC211

L	T	P	C
3	1		3

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Outcomes :

The student will be able to :

CO - 1	Understanding the concepts of Gradient ,Divergence and Curl and finding scalar potential function of irrotational vector fields.
CO - 2	Understanding the concepts of Green's Theorem, Stokes' Theorem and the Divergence Theorem and to evaluate line integrals, surface integrals and flux integrals.
CO - 3	Understand some basic techniques for solving linear partial differential equations and how to identify a partial differential equation in order to determine which technique(s) can best be applied to solve it.
CO - 4	Apply the method of separation of variables to solve the heat flow and wave equations.
CO - 5	Understand the principles of Fourier transforms and apply them to Boundary value problems.

Mapping of course outcomes with program outcomes :

Course Outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO - 1	3	2	2	1					2		1	
CO - 2	3	2	2	1					2		1	
CO - 3	3	2	2	1					2		1	
CO - 4	3	2	2	1					2		1	
CO - 5	3	2	2	1					2		1	

Course Outcomes	PSO1	PSO2
CO-1	2	2
CO-2	2	2
CO-3	2	2
CO-4	2	2
CO-5	2	2

UNIT-I : VECTOR DIFFERENTIATION (12 Periods)

Differentiation of Vectors – Scalar and Vector point function – Del applied to Scalar point functions - Gradient geometrical interpretations – Directional Derivative - Del applied to vector point function – divergence - Curl – Physical interpretation of Divergence and Curl - Del applied twice to point functions- Del applied to product of point functions.

UNIT-II : VECTOR INTEGRATION (12 Periods)

Integration of vectors – Line integral – Surface – Green's theorem in the plane – Stokes theorem – Volume integral – Gauss Divergence theorems (all theorems without proofs) – Irrotational fields .

UNIT-III : PARTIAL DIFFERENTIAL EQUATIONS (12 Periods)

Introduction – Formation of Partial Differential Equations – Solution of Partial Differential Equations by Direct Integration – Linear Equations of the First order – Higher order Linear Equations with Constant Co-efficients – Rules for finding the complementary function - Rules for finding the Particular integral – Non- Homogeneous linear equations with constant coefficients.

UNIT –IV : APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (12 Periods)

Introduction – Method of separation of variables – Vibrations of a stretched string- Wave equation – One dimensional Heat flow - Two dimensional Heat flow – Solution of Laplace's equation.- Laplace's equation in Polar Co-ordinates.

UNIT-V : FOURIER TRANSFORMS (12 Periods)

Introduction – definition – Fourier integral theorem - Fourier sine and cosine integrals – Complex form of Fourier integrals – Fourier integral representation of a function – Fourier Transforms – Properties of Fourier Transforms – Convolution Theorem – Parseval's identity for Fourier transforms – Fourier Transforms of the Derivatives of functions – Application of Transforms to Boundary value problems – Heat conduction – Vibrations of a string.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, 43rd Edition, Khanna Publishers, New Dehli, 2014.

Reference books:

1. A Text book on Engineering Mathematics by N.P. Bali Etal, Laxmi pub.(p)Ltd , 2001.
2. Advanced Engineering Mathematics by H.K.Dass , S.Chand Publications, 2007.
3. Advanced Engineering Mathematics by Erwin kreyszig, John Wiley Publications, 1999.

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – I SEMESTER

MATERIAL SCIENCE AND METALLURGY

Course Code: MEC212	**L**	**T**	**P**	**C**
	4	**0**	**0**	**3**

Course Objectives:

To give an insight to the student on the fundamentals of materials, their structure, properties, applications and failure mechanisms. Besides, introduce the different heat treatment methods, classify and study ferrous and non-ferrous alloys, composites and basics of Powder Metallurgy and NDT.

Course Outcomes:

Students will be able to:

CO-1	Gain knowledge of fundamental structures of materials and their properties.
CO-2	Understand the fundamentals of various phases of alloys and heat treatment methods.
CO-3	Classify and understand the properties and applications of ferrous and non-ferrous alloys.
CO-4	Understand the modes of plastic deformation and failure mechanisms and basic principles of powder metallurgy.
CO-5	Understand the principles and synthesis of composite materials and powder Metallurgy components

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1	2	1	3	2			1					1
CO-2	3	2	1	3			3					1
CO-3	1	2	3	2			1					
CO-4	3	3	3	2			2					1
CO-5	2	3	3	3	1	3	3	1	2	3	3	3

Course Outcomes	PSO1	PSO2
CO-1	2	2
CO-2	2	1
CO-3	2	2
CO-4	3	2
CO-5	3	3

UNIT-I

Engineering Materials: Properties , classification of materials, Advanced Materials.
Crystalline Solids:
Unit cells, crystal systems, Bravais Lattices, Atomic packing factor, Miller Indices for Crystallographic planes and directions. Crystal Defects: point, line and surface defects.

Employability

UNIT-II

Binary Phase Diagrams.
Gibbs Phase rule. Lever rule. Invariant reactions. Iron-Iron Carbide phase diagram. **Heat treatment of steel.** Isothermal transformation curves. Annealing, Normalizing, Hardening, Tempering, Austempering and Martempering of steels. Surface hardening of steels. Carburizing, Nitriding, Cyaniding, Flame and induction hardening methods.

Employability

UNIT-III

Steels and Cast Irons:
AISI-SAE classification of steel, Structure and properties of plain-carbon steels, low alloy steels, Tool steels, Stainless steels. Types of Cast irons. Grey CI, White CI, Malleable and Spheroidal Graphite irons, Alloy cast irons.
Non-ferrous metals and alloys: Brasses and Bronzes, Bearing metals, Titanium alloys

Employability

UNIT-IV
Plastic Deformation: Slip, Twinning, critical resolved shear stress. Strain hardening and other strengthening mechanisms
Material Failure Mechanisms: Ductile and Brittle fracture, Ductile to Brittle transition, fundamental concepts of creep and fatigue failure, creep curve.

Employability

UNIT-V
Composite Materials
Classification, Matrices and reinforcements, polymer matrix composite, ceramic matrix composite and metal matrix composites. Fabrication methods of composites.
Powder Metallurgy: Principles of Powder Metallurgy Process, Basic steps in Powder

Employability

Metallurgy , Powder Manufacture, Powder Blending, Powder Compaction, Sintering. Advantages & limitations.

Text Books:

1. Material Science and Metallurgy for Engineers, V.D. Kodgire & S.V. Kodgire, Everest Publishing House.
2. Introduction to Physical Metallurgy, S.H. Avner, Tata McGraw Hill edition.

Reference Books:

1. Material Science and Engineering, L.H.Van Vleck, 5^{th} edition, Addison Wealey (1985).
2. Structure and Properties of Materials, R.M. Rose, L.A. Shepard and J. Wulff Vol.1, John Willey (1966).
3. Essentials of Material Science, A.G. Guy ,McGraw-Hill (1976).
4. Material Science and Engineering, V. Raghavan ,Printice Hall of India.

ENGINEERING MECHANICS

Course Code: MEC 213

L	T	P	C
4	1	0	4

Course Objectives: To enable the students understand and distinguish different force systems, evaluate the conditions required for their equilibrium, apply the concepts of dry friction, determine the properties of surfaces and solids, distinguish between particle and rigid body mechanics and further apply the principles of dynamics to bodies in motion.

Course Outcomes: At the end of the course the student will be able to:

CO-1	Classify the force systems, evaluate their resultant and draw the free body diagram of any practical problem and determine the conditions required for equilibrium using the principles of mechanics.
CO-2	Analyze and determine the forces in trusses and also apply the concepts of dry friction to some basic applications of Mechanical engineering.
CO-3	Evaluate the properties of plane surfaces including composite areas like centroid, moment of inertia & extend the concepts to solids.
CO-4	Distinguish between particle and rigid body and apply the concepts of kinematics and kinetics to analyze forces on particles under rectilinear and curvilinear motions.
CO-5	Apply the principles of dynamics to rigid bodies and also understand the concepts of Simple harmonic motion & compound pendulum.

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	3	3	2	_	_	_	_	_	_	_	1
CO-2	3	3	3	2	_	_	_	_	_	_	_	1
CO-3	3	3	3	2	_	_	_	_	_	_	_	1
CO-4	3	3	3	2	_	_	_	_	_	_	_	1
CO-5	3	3	3	2	_	_	_	_	_	_	_	1

Course Outcomes	PSO1	PSO2
CO-1	3	2
CO-2	3	2
CO-3	3	2
CO-4	3	2
CO-5	3	2

UNIT –I

STATICS :

Introduction to Engineering mechanics, Scalar and vector quantities, vector operations

Statics of Particles: Fundamental concepts and principles- Resultant of coplanar concurrent forces and non-concurrent forces, Free body diagrams, Equilibrium of particles. Resultant of concurrent and non-concurrent forces in space (vector method only).

Employability

Statics of rigid bodies: Moments and Couples-Varignon's theorem – Free body diagram- Equivalent force and couple – Types of supports and their reactions – Equilibrium of Rigid bodies in two dimensions. Principles of superposition and transmissibility.

Employability

UNIT –II

ANALYSIS OF TRUSSES AND FRICTION:

Employability

Trusses: Definition of a truss - Simple Trusses - Analysis of planar Trusses - Method of joints-Method of sections.

Friction: Characteristics of Dry Friction, Problems related to dry friction - Wedges –ladders

Employability

UNIT - III

PROPERTIES OF SURFACES AND SOLIDS:

Employability

Centroids & Centre of Gravity: Centroids of lines & areas, C.G of volumes –determination by first principles, composite areas- Theorem of Pappus-Guldinus.

Moment of Inertia: Moment of inertia of an area- Radius of gyration - Parallel and perpendicular axis theorems – Polar moment of inertia - Mass moment of inertia.

Employability

UNIT –IV

DYNAMICS OF PARTICLES:

Employability

Displacements, Velocity and acceleration, their relationship – relative motion – Rectilinear and Curvilinear motion.
Newton's laws – D'Alembert's Principle-Work-Energy Equation of particles – Impulse and Momentum –Impact of elastic bodies- Impact - direct and central impact – coefficient of restitution.

UNIT - V

DYNAMICS OF RIGID BODIES:

Rotation of rigid body, General plane motion –Velocity and Acceleration- Absolute and Relative motion method.
Equilibrium of rigid bodies in plane motion- Newton's Laws- D'Alembert's Principle-Work Energy Principle-Principle of impulse momentum for rigid bodies in plane motion. Simple harmonic motion - Compound pendulum.

Text Books:

1. Engineering Mechanics by S. Timoshenko and D.H.Young, McGraw-Hill
2. Vector Mechanics for Engineers: Statics and Dynamics by Ferdinand P.Beer & E. R. Johnston (9th Edition), Tata McGraw-Hill International Edition.
3. Engineering Mechanics by S.S.Bhavikatti, New age international publishers

Reference Books:

1. Engineering Mechanics – STATICS by J. L. Meriam and L. G. Kraige, Wiley India edition
2. Engineering Mechanics – DYNAMICS by J. L. Meriam and L. G. Kraige, Wiley India edition
3. Engineering Mechanics – Statics and Dynamics by Irving Shames, Prentice Hall of India
4. Engineering Mechanics by K.L.Kumar, McGraw-Hill.
5. Engineering Mechanics – Statics and Dynamics by A.K.Tayal.

Web resources:

NPTEL lectures

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – I SEMESTER

MECHANICS OF SOLIDS

Course Code: MEC214	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

Prerequisite: Mathematics-I & II

Course Objectives:

To make the students understand the effect of forces on deformable bodies under various loading conditions, and thus calculate various types of stresses such as direct stresses, bending stresses, torsional stresses and evaluate deflection of beams. The objective is also to provide the fundamental principles involved in strength of materials to enable them to apply in the study of advanced subjects.

Course Outcomes:

Students will be able to:

CO-1	Distinguish between various mechanical properties like yield strength, ultimate strength etc., of a given material and also to determine various types of stresses.
CO-2	Analyze the effect of shear force & bending moment on various beams
CO-3	Evaluate the slope and deflection induced in the beams by various methods.
CO-4	Determine the torsional stresses in shafts and buckling stresses in columns.
CO-5	Differentiate between thick and thin shells and determine the stresses induced and strains when subjected to internal and external pressure.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

COURSE OUTCOMES	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**	**1**	**1**	**1**							**1**
CO2	**3**	**3**	**3**	**2**	**1**							**1**
CO3	**3**	**3**	**2**	**1**	**1**							**1**
CO4	**2**	**2**	**3**	**2**	**1**							**1**
CO5	**3**	**3**	**3**	**3**	**1**							**1**

Course Outcomes	PSO1	PSO2
CO-1	2	1
CO-2	3	2
CO-3	3	2
CO-4	2	2
CO-5	3	2

Employability

Unit-I –Stresses and Strains:

Stress –Strain, Stress Strain diagram, Poisson's ratio, Elastic constants and their relationship ,Generalized Hook's law, Factor of safety, Strain energy, Impact loading ,Deformation of simple and compound bars.

Thermal stresses , Stresses on an inclined plane under uni-axial, bi-axial, pure shear & combined loading, principal stresses & strains, Mohr's circle for plane stresses.

Employability

Unit-II- Analysis of Beams:

Types of beams and loads, Shear Force and Bending Moment diagrams for cantilever, simply supported and over hanging beams.

Theory of pure bending, flexural formula, shear stress distribution in beams (rectangle, circular, I, T & L sections).

Employability

Employability

Unit-III -Deflection of beams:

Relation between curvature, slope and deflection, deflection of simply supported, cantilever and overhanging beams by double integration method, Macaulay's method, moment area method.

Employability

Unit-IV -Torsion and columns:

Introduction to pure torsion, torsional formula, torsion of circular and hollow shafts.

Theory of columns – long and short columns, Euler's theory, crippling load, Rankine's theory, columns carrying eccentric load, empirical formulae.

Employability

Employability

Unit-V-Thin & Thick cylinders:

Stress & Strains in thin cylinders & spherical shells.

Introduction to thick cylinder –Lame's equation, cylinder subjected to internal and external pressures.

Employability

Text Books:

01. Mechanics of Materials, Gere & Timoshenko ,CBS Publishers.

02. Strength of Materials, S.S.Ramamrutham & R, Narayanan ,Dhanpat Rai publications.

References:

01. Strength of Materials, Dr Sadhu Singh,Khanna publications

02. Strength of materials, R.K.Rajput ,S.Chand Ltd.publications
03. "Engineering Mechanics of solids" Egor P.Popov ,second edition, prentice hall of India pvt. Ltd, New Delhi, .
04. "A Text Book of Strength of Materials, R.K.Bansal ,Lakshmi Publications Pvt. Ltd,New Delhi
05. Mechanics of materials, Jhonston Beer and Mazurek Dewol 6 th Edition

Web References:

1) http://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/strength%20of%20materials/homepage.htm
2) http://www.aboutcivil.org/solid-mechanics.html
3) http://web.mit.edu/emech/dontindex-build/
4) http://web.aeromech.usyd.edu.au/AMME2301/Documents/
5) http://www.faadooengineers.com/threads/9673-Mechanics-of-Solids-Lecture-Notes-Pdfs-Full-Notes-All-Units-Download
6) http://www.ijee.ie/OnlinePapers/Interactive/Philpot/philpot_media_mm.htm

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – I SEMESTER

ENGINEERING THERMODYNAMICS-I

Course Code: MEC215	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

Prerequisite: Engineering Physics-I

Course Objectives:

To provide the student with a simplistic and practical approach to the fundamental subject of thermodynamics and create an interest and intuitive understanding of the nuances of this core subject which deals with energy and its different forms and to solve any real time engineering problems.

Course Outcomes:

The student will be able to:

CO-1	Understand the basic concepts of thermodynamics and identify the interaction between system and surroundings.
CO-2	Understand the basic laws of thermodynamics and apply these laws to analyze various flow and non flow systems.
CO-3	Understand and apply the concept of 2nd law of thermodynamics, ideal process & availability to evaluate the performance of cyclic devices, flow and non flow systems.
CO-4	Evaluate the properties of gas mixtures and apply gas laws to compute energy transfers and change in properties of the flow and non-flow systems during a process.
CO-5	Evaluate the air standard efficiency of various air standard cycles and compare the relative merits and demerits.

Mapping of Course Outcomes with Programme Outcomes.

High-3, Medium-2, Low-1

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	1	2	1	1			3			1	1	
CO-2	3	3	2	2			3	1			1	
CO-3	3	3	3	3		2	3	2		1	1	
CO-4	3	3	3	3			2		1			
CO-5	3	3	3	3		2	3	2		1		

Course Outcomes	PSO1	PSO2
CO-1	2	1
CO-2	3	2
CO-3	3	2
CO-4	3	2
CO-5	3	2

Employability

UNIT – I

Basic Concepts-System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle, Quasi – static Process, Energy in State and in Transition, Work and Heat, Path and Point functions.

UNIT II

Zeroth Law of Thermodynamics – Concept of equality of Temperature –Reference Points – PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a flow system – Steady Flow Energy Equation, throttling & free expansion processes. Limitations of the First Law.

Employability

UNIT – III

Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence, Corollaries, PMM-II, Carnot's principle, Reversibility and Irreversibility, Causes of Irreversibility, Carnot cycle, Clausius Inequality, Entropy, Principle of Entropy Increase – Availability and Irreversibility –Quality of energy , Dead state, Availability in non-flow & flow processes, Gouy–stodola equation.

Employability

UNIT -IV

Perfect Gas & Gas mixtures: – Equation of State, Characteristic and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy and enthalpy – Deviations from perfect Gas Model – Vander Waals Equation of State. Gas mixtures-Daltons law and Gibbs-Dalton law, apparent molecular weight and gas constant, specific heats of gas mixture, volumetric & gravimetric analysis of gas mixtures, adiabatic mixing of perfect gases.

Employability

UNIT - V

Power Cycles: Otto, Diesel, Dual Combustion cycles, Stirling & Ericcson Cycles – Description and representation on P–V and T-S diagram, Thermal Efficiency.

Employability

Text books:

1. Engineering Thermodynamics, P.K.Nag ,Tata McGraw Hill publication.
2. Thermal Science & Engineering, Dr.D.S.Kumar ,S.K.Kataria & sons publication.

Reference Books:

1. Engineering Thermodynamics, Cengel & Boles,TMH publications
2. Thermal Engineering, R.K.Rajput S.Chand & Co.

Web sources:

1. http://nptel.ac.in/courses/112108148/
2. http://nptel.ac.in/courses/112105123/
3. http://nptel.ac.in/courses/112104113/
4. http://highered.mheducation.com/sites/007352932x/student_view0/index.html
5. http://physics-animations.com/Physics/English/thermo.htm
6. https://www.youtube.com/watch?v=CmaTnV4m93E
7. http://wps.prenhall.com/wps/media/objects/2688/2752944/Web_Tutorials/06_A01.swf

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – I SEMESTER

MANUFACTURING TECHNOLOGY - I

Course Code: MEC216

L	T	P	C
4	**0**	**0**	**3**

Course Objective:

To make the students learn about fundamental manufacturing concepts and understand various manufacturing processes such as casting, forming and fabrication.

Course Outcomes:

Students will be able to:

CO-1	Describe and illustrate various casting processes and their components
CO-2	Design molding system and evaluate the defects in casting
CO-3	Define and design various forming and forging processes
CO-4	Understand the principles of sheet metal operations and basics of metal joining processes
CO-5	Explain advanced welding processes and able to analyze weld defects

Mapping of Course Outcomes with Programme Outcomes.

High-3, Medium-2, Low-1

COURSE OUTCOMES	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	1	1	1		1		1		1	1
CO2	3	3	3	2	1		1		1		1	1
CO3	3	2	3	2	1		1		1		1	3
CO4	2	3	2	1	1		1		1		1	1
CO5	2	3	3	2	1		1		1		1	3

Course Outcomes	PSO-1	PSO-2
CO-1	1.4	0
CO-2	2.4	1.2
CO-3	2.6	1.8
CO-4	2.4	2
CO-5	2.6	1.8

UNIT - I

Employability

Introduction to Manufacturing:

Product cycle; Job, batch and mass production; Primary and secondary manufacturing processes.

Employability

Principles of metal casting:

History of metal casting, applications and limitations, Terminology in casting, sand mould making procedure, Patterns, Classification of patterns, pattern materials, pattern allowances, core prints. Moulding materials, moulding sand composition, sand properties testing procedures, moulding sand preparation and its classification, Sand moulding machines, core sands, types of cores, chaplets. Gating system design - Elements of gating system, Risering design – Caine's method and Modulus method, feeding distances, chills.

UNIT - II

Metal Casting Processes & N.D.T Techniques:

Classification of Furnaces, fettling, defects in castings, Types of mould - Chemical sand moulding, Permanent moulding processes, Special casting processes – Centrifugal casting, Precision investment casting, Continuous casting, Plaster mould casting, Squeeze casting, Evaporative casting, Vacuum sealed casting. Casting Defects, Non-destructive testing methods – Visual inspection, Liquid penetrant and die penetrant test, magnetic particle inspection test, Ultrasonic inspection and radiography tests.

Employability

UNIT - III

Introduction to Metal Forming & Bulk Forming Processes:

Nature of plastic deformation, hot working and cold working. Rolling – Principle, Rolling stand arrangement, Rolling load. Forging – Principle, Forging operations – Smith forging, drop forging, press forging and machine forging. Forging pressure distribution and forging force, Extrusion – hot and cold extrusions, tube extruding, wire drawing, rod and tube drawing, swaging.

Employability

Employability

UNIT - IV

Sheet Metal Forming & Basics of Metal Joining Processes:

Sheet metal operations,– shearing, drawing, bending, squeezing, press working and its classification, types of dies, press tool operations – cutting operations (blanking, punching, notching, etc.), shaping operations (embossing, coining, spinning, stretch forming, etc.), high energy rate forming processes, Classification of fabrication processes, types of joints, Soldering, brazing and braze welding,

Employability

Employability

UNIT - V

Metal Joining Processes:

welding terminology, Principles and processes – gas welding and cutting, Electric arc welding (MMAW, CAW, TIG, GMAW, SAW, PAW, AHW, SW, fire cracker welding),.
Resistance welding (spot, seam, projection, upset and flash welding techniques), Solid state welding – Cold or roll welding, explosion welding, friction welding, friction stir welding, ultrasonic welding. Thermit welding, electro slag welding, laser beam welding, forge welding, diffusion welding. Welding defects.

Employability

Text Book:

1. Manufacturing Technology-Foundry, Forming and Welding, P.N. Rao, 4th Edition, Tata McGraw-Hill Publishing Company.

2. Manufacturing Engineering & Technology, Kalpak Jain, 7th Edition, Addition Wesley Edition.

Reference Books:

1. Materials and Processes in Manufacturing, De Garmo, Black and Kohsen 4th Edition, Prentice Hall of India.

2. Manufacturing Science (English) 2nd Edition, Amithaba Ghosh and Asok Kumar Mallik ,East West Press Pvt. Ltd.

3. Principles of Metal Casting, Hein and Rosenthol, 5th Edition, Tata McGraw Hill India.

Web sources: www.wri.org.in

4. Hein and Rosenthol, Principles of Metal Casting, 5th Edition, Tata McGraw Hill India.

Web sources: www.wri.org.in

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – I SEMESTER

STRENGTH OF MATERIALS LAB

Course Code: MEC217	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

Course Objectives:

The objective is also to make the students observe the response of the material under different loads and measure the properties which include tensile strength, impact strength, hardness, stiffness and elastic constants.

Course Outcomes:
Students will be able to:

CO-1	Measure and analyze the various properties of materials under tensile/compressive loads.
CO-2	Determine the modulus of rigidity of a material by subjecting it to a twisting moment and also for a given spring material.
CO-3	Determine the hardness and impact strength of a given material.
CO-4	Determine modulus of elasticity of a given beam material.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**1**	**2**	**2**	**2**	**1**			**1**		**1**		
CO2	**1**		**1**	**1**	**1**			**1**		**1**		
CO3	**1**		**1**	**1**	**1**			**1**		**1**		
CO4	**1**		**1**	**1**	**1**			**1**		**1**		

Course Outcomes	PSO1	PSO2
CO-1	2	2
CO-2	1	1
CO-3	1	1
CO-4	1	1

List of Experiments:

(any 10 Experiments)

1. To study the stress- strain characteristics of materials under tensile load by using UTM.
2. Determination of compressive strength of wood by using UTM.
3. Determination of hardness using Brinnels hardness tester.
4. Determination of hardness using Rockwell's hardness tester.
5. Determination of Vickers hardness number by using Vickers hardness tester.
6. Impact test by using Izod method.
7. Impact test by using Charpy method.
8. To find stiffness and modulus of rigidity by conducting compression tests on springs.
9. Torsion tests on circular shafts.
10. To conduct shear test on mild steel bar using UTM.
11. To determine modulus of elasticity of given wooden bar by using the principle of simply supported beam
12. To determine modulus of elasticity of given mild steel bar by using the principle of simply supported beam
13. To determine modulus of elasticity of given wooden bar by using the principle of cantilever beam.
14. To determine modulus of elasticity of given mild steel bar by using the principle of cantilever beam.

Employability

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – I SEMESTER

MECHANICAL ENGINEERING LAB – I

Course Code: MEC218

L	T	P	C
0	0	3	2

Course Objectives:

To make the students conversant with the experimentation involved in measuring the properties of fuels and lubricants, giving an insight into the construction and operation of two stroke and four stroke engines, air compressor & Boilers and further using kinematic principles to determine mass moment of inertia of connecting rod and flywheel.

Course Outcomes:

The students will be able to:

CO-1	Draw the port timing and valve timing diagrams for 2S and 4S I.C engines.
CO-2	Analyze the properties like flash point, fire point, calorific value and viscosity of various fluids.
CO-3	Calibrate measuring instruments like pressure gauge.
CO-4	Evaluate the volumetric efficiency of single stage reciprocating air compressor.
CO-5	Explain the working of various types of boilers & their accessories
CO-6	Evaluate the moment of inertia for flywheel & connecting rod.
CO-7	Determine the modulus of rigidity of the given material using torsional pendulum principle.
CO-8	Disassemble & assemble an I.C engine & identify its components.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	0	0	1	0	1	1	0	1
CO2	2	1	1	2	0	0	1	0	1	1	1	1
CO3	1	1	1	2	0	0	0	0	1	1	0	1
CO4	2	1	1	2	0	0	0	0	0	1	0	0
CO5	0	0	1	0	0	0	1	0	0	1	0	1
CO6	2	2	2	2	0	0	0	0	0	1	0	0
CO-7	2	1	1	2	0	0	1	0	1	1	1	1
CO-8	0	0	1	0	0	0	1	0	0	1	0	1

Course Outcomes	PSO1	PSO2
CO-1	1	1
CO-2	2	1
CO-3	1	1
CO-4	2	1
CO-5	1	1
CO-6	2	2
CO-7	2	1
CO-8	1	1

List of Experiments:

(any 10 Experiments)

1. To draw valve timing diagram for four-stroke & port timing diagram for two-stroke engines.
2. Determination of volumetric efficiency of the given air compressor by plate orifice method.
3. Determination of volumetric efficiency of the given air compressor by tank capacity method.
4. Calibration of the given pressure gauge.
5. Determination of flash and fire points of fuel oils.
6. Determination of calorific value of gaseous fuel by using Junker's gas calorimeter.
7. Determination of the kinematic and absolute viscosity of the given lubricating oil samples.
8. Determination of moment of inertia of a given flywheel.
9. Determination of moment of inertia of a given connecting rod.
10. Determination of modulus of rigidity of the material of the wire using the principle of torsional pendulum.
11. Study of boilers, various mountings and accessories.
12. Disassembling & assembling of a two-stroke/ four-stroke engine.

skill development

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

MATHEMATICS - IV
(COMMON TO CHEMICAL & MECHANICAL)

Course Code: MEC221	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Outcomes:
The student will be able to:

CO - 1	Understand the characteristics and properties of Z-transforms and apply them in engineering problems
CO - 2	Familiarize with the formation of Difference Equations and method of solving them.
CO - 3	Understand, interpret and use the basic concepts like analytic functions, harmonic functions, Taylor and Laurent series and singularity.
CO - 4	Understand the concepts of Residues , evaluate definite integrals using the technique of residues and further understand the concepts of conformal mappings.
CO - 5	Analyze the Statistical data by using statistical tests (based on small sample and large sample) and draw valid inferences based on the analysis of statistical data.

Mapping of course outcomes with program outcomes:

Course Outcomes	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO - 1	**3**	**2**	**2**	**1**					**2**		**1**	
CO - 2	**3**	**2**	**2**	**1**					**2**		**1**	
CO - 3	**3**	**2**	**2**	**1**					**2**		**1**	
CO - 4	**3**	**2**	**2**	**1**					**2**		**1**	
CO - 5	**3**	**2**	**2**	**1**					**2**		**1**	

Course Outcomes	PSO1	PSO2
CO-1	2	2
CO-2	2	2
CO-3	2	2
CO-4	2	2
CO-5	2	2

UNIT-I : FUNCTIONS OF A COMPLEX VARIABLE (12 Periods)

Introduction –Limit of a Complex function- Derivative of f(z) – Analytic functions- Harmonic functions - Applications to Flow problems. Complex Integration- Cauchy's Theorem- Cauchy's Integral Formula –Series of Complex terms (Statements of Taylor's and Laurent's Series without proof) - Zeros of an Analytic function .

UNIT-II : FINITE DIFFERENCES & INTERPOLATION (12 Periods)

Finite Differences – Forward differences – Backward differences – Central differences – Differences of a Polynomial – Factorial Notation – Other difference operators – To find one or more missing terms – Newton's Interpolation Formulae – Central Difference Interpolation Formulae - Interpolation with Unequal Intervals – Lagrange's interpolation formula – Inverse Interpolation.

UNIT-III: NUMERICAL DIFFERENTIATION AND INTEGRATION (12 Periods)

Numerical Differentiation – Formulae for derivatives – Maxima and Minima of a Tabulated Function – Numerical Integration – Newton-Cotes Quadrature Formula – Trapezoidal rule – Simpson's One-Third rule , Simpson's Three-Eighth rule.

UNIT-IV: PROBABILITY AND DISTRIBUTIONS (12 Periods)

Introduction – Basic Terminology – Probability and set notations – Addition Law of Probability – Independent events – Baye's Theorem – Random variable – Discrete Probability Distribution – Continuous Probability Distribution – Binomial Distribution - Poisson distribution - Normal Distribution. (Mean , Variance , Standard Deviation and their properties without proofs).

UNIT-V: SAMPLING THEORY (12 Periods)

Introduction – Sampling Distribution – Testing a hypothesis – Level of Significance – Confidence Limits – Test of Significance of Large samples (Test of significance of single mean, difference of means) – Confidence limits for unknown – Small samples – Students t-distribution – Significance test of a sample mean – Significance test of difference between sample means – Chi-Square (3^2) Test – Goodness of fit.

Text Books:

1. Dr. B.S. Grewal, Higher Engineering Mathematics, 43^{rd} Edition, Khanna Publishers, New Dehli, 2014.

Reference books:

1. A Text book on Engineering Mathematics by N.P. Bali Etal, Laxmi pub.(p)Ltd , 2011.
2. Advanced Engineering Mathematics by H.K.Dass , S.Chand Publications, 2007.
3. Advanced Engineering Mathematics by Erwin kreyszig, John Wiley Publications, 1999.

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code: MEC222	**L**	**T**	**P**	**C**
	4	**0**	**0**	**3**

Course Objectives:

To acquaint the students with the analysis of circuits by using KCL & KVL, operation and applications of DC & AC machines, various indicating instruments and the concepts of diodes & transistors

Course Outcomes:

Students will be able to:

CO1	Solve the circuits by using Basic theorems.
CO2	Understand the working principle of DC machines and single phase transformer
CO3	Find the regulation of Alternator and operation of an induction motor.
CO4	Gain knowledge on diodes and transistors.
CO5	Understand the working principle of indicating instruments and CRO.

Mapping of course outcomes with program outcomes

COURSE OUTCOMES	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**								**1**		**1**	
CO2	**1**			**1**					**1**		**1**	
CO3	**1**			**1**					**1**		**1**	
CO4	**1**			**1**					**1**		**1**	
CO5	**1**								**1**		**2**	

Course Outcomes	PSO1	PSO2
CO-1	1	1
CO-2	1	1
CO-3	1	1
CO-4	1	1
CO-5	1	1

SKILL DEVELOPMENT

UNIT – I

ELECTRICAL CIRCUITS: Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations.

SKILL DEVELOPMENT

UNIT-II

DC MACHINES: Principle of operation of DC Generator – emf equation - types – DC motor types –torque equation – applications – three point starter.
TRANSFORMERS: Principle of operation of single phase transformers – emf equation – losses –efficiency and regulation

SKILL DEVELOPMENT

UNIT – III

AC MACHINES: Principle of operation of alternators – regulation by synchronous impedance method –Principle of operation of induction motor – slip – torque characteristics applications.

UNIT – IV

DIODE AND IT'S CHARACTERISTICS: P-N junction diode, symbol, V-I Characteristics, Diode Applications, Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems)
TRANSISTORS: PNP and NPN Junction transistor, Transistor as an amplifier, SCR characteristicsand applications

SKILL DEVELOPMENT

UNIT – V
INSTRUMENTS: Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments, CRO: Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Applications of CRO - Voltage, Current and frequency measurements.

SKILL DEVELOPMENT

TEXT BOOKS:

1. Essentials of Electrical and Computer Engineering by David V. Kerns, JR. J. David Irwin/Pearson.
2. Principles of Electrical and Electronics Engineering by V.K. Mehta, S. Chand& Co.

REFERENCES:

1. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH Publ.
2. Basic Electrical Engineering by Kothari and Nagarath, TMH Publications, 2nd Edition.

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

FLUID MECHANICS

Course Code: MEC223

L	T	P	C
4	**1**	**0**	**4**

Prerequisites:

Engineering Mathematics – I, Engineering Mechanics.

Course Objective:

To acquaint the student with the fundamental & advanced principles of fluid mechanics and their application to any practical problem involving fluids to find a solution.

Course Outcomes:

The student will be able to:

CO-1	Understand and apply the basic concepts of physical parameters like viscosity, surface tension, capillarity etc. in practical fluid flow problems.
CO-2	Apply the concepts of continuity, Impulse-momentum equation and Angular momentum principle to fluid flow problems.
CO-3	Determine the loss of energy in flow through pipes under various configurations and further critically analyze viscous flows.
CO-4	Get an overall view of boundary layer theory and its related concepts and further apply the principles of dimensional analysis to any physical phenomena.
CO-5	Analyze flow over submergible bodies like sphere, cylinder, airfoil and the forces exerted on them.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1								1
CO2	3	3	3	2	1	1	1				1	1
CO3	3	3	3	2	1	1	1				1	1
CO4	3	3	3	3	1		1			1	1	2
CO5	3	3	3	3	1		2		1		1	2

Course Outcomes	PSO1	PSO2
CO-1	2	2
CO-2	3	2
CO-3	3	2
CO-4	3	2
CO-5	3	3

UNIT-I

Employability

Fluid Statics:

Properties of fluids - Fluid Pressure and its measurement - Manometers, Simple manometers, Differential manometers. Hydrostatic forces on surfaces. Total Pressure and Centre of pressure - Horizontal, Vertical, Inclined and Curved plane surfaces submerged in liquid - Buoyancy and Floatation, Applications.

Employability

UNIT-II

Fluid Kinematics & Dynamics:

Types of fluid flow - velocity and acceleration - continuity equation - velocity potential and Stream Function - Flow net Analysis. Types of Motion, Linear translation, Linear deformation, Angular deformation, Rotation, vorticity and circulation.

Forces acting on fluid in motion - Equation of Motion - Euler's equation - Navier–Stokes equation - Order of magnitude analysis - Bernoulli's equation and its applications - Venturimeter, Orifice Meter, Pitot tube - Momentum Equation - Impulse-Momentum equation - Angular momentum principle - Forces on pipe bend - Vortex flow, forced and free vortex.

Employability

UNIT-III

Flow through pipes: Reynolds Experiment - Laws of fluid friction - Darcy weisbach equation, Major Losses and Minor losses - Hydraulic gradient line, Total energy line, Pipes in series and pipes in parallel - Equivalent pipe - Branched pipes - siphon, Transmission of power through pipes.

Laminar Flow: Introduction, Relation between shear and pressure gradient - Laminar flow in circular pipes - Hagen–Poiseuille law - couette flow analysis.

Employability

UNIT-IV

Boundary layer theory: Introduction to Boundary layer concepts - Thickness of Boundary layer - Boundary layer equations - Momentum integral equation, Laminar and Turbulent boundary layer, Separation of boundary layer and methods of controlling.

Dimensional and Modeling Analysis: Fundamental and derived dimensions - Dimensionless groups - Rayleigh method - Buckingham method - Model Analysis - Types of similarity-Geometric, Kinematic and Dynamic similarities - Dimensionless numbers - Model Laws.

Employability

UNIT-V

Drag & Lift: Introduction - Types of drag - drag on a sphere, cylinder, flat plate and airfoil, Variation of coefficient of drag.

Development of lift on immersed bodies - circular cylinder and airfoil.

Employability

Text Book:

1. Hydraulics and fluid Mechanics by Modi and Seth, 12th ed. 1998, Standard Book House, Delhi

2. Fluid Mechanics and Fluid Power Engineering by Dr. D.S. Kumar, S.K. Kataria &Sons.

References:

1. Fluid Mechanics and Hydraulic machines by R.K. Bansal, 8th ed. 2002, Laxmi publication (P) Ltd.
2. Fluid Mechanics by V.L. Streeter & E.B. Wylie, 1st SI metric ed. 1981, McGraw Hill Book Company.
3. Foundations of Fluid Mechanics, by Yuan, Prentice Hall of India.
4. Fluid Mechanics by Yunus Cengel and Cimbala.

5. Fluid Mechanics Franck .M White Tata Mc GrawHill Publication 2011.

Web Resources:

http://www.science-animations.com/fluidmechanics.html

https://iitbmechdamp.wordpress.com/me-203-fluid-mechanics/

http://nptel.ac.in/courses/112105171/1

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

THEORY OF MACHINES-I

Course Code: MEC224	**L**	**T**	**P**	**C**
	4	**1**	**0**	**4**

Prerequisite: Engineering Mechanics

Course Objectives:

To acquaint the students with the fundamentals of mechanisms and their kinematic analysis. Further this study is extended to specific applications like steering mechanisms, Hooke's joint, cams, gears and gear trains.

Course Outcomes:

The Student will be able to:

CO-1	Understand the basic concepts of different mechanisms and their inversions.
CO-2	Understand and analyze mechanisms like straight line motion mechanisms & steering gear mechanisms and Hooke's joint.
CO-3	Perform kinematic analysis of any given simple mechanisms.
CO-4	Design cam profiles based on the prescribed follower motion and perform kinematic analysis on cams with specified contours.
CO-5	Get acquainted with gear terminology, distinguish gears & perform kinematic analysis of gears & gear trains.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

COURSE OUTCOMES	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**3**			**2**			**2**		**2**
CO2	**3**	**3**	**1**	**3**					**2**	**1**	**1**	**2**
CO3	**3**	**3**	**2**	**3**						**2**	**2**	**2**
CO4	**3**	**2**	**3**	**2**						**2**	**2**	**1**
CO5	**3**	**3**	**3**	**3**			**2**			**2**	**2**	**2**

Course Outcomes	PSO1	PSO2
CO-1	3	2
CO-2	3	1
CO-3	3	2
CO-4	3	2
CO-5	3	2

UNIT – I

Mechanisms and Machines: Introduction; Mechanism and machine; Rigid and resistant bodies; Link; Kinematic pair; Degrees of freedom; Classification of kinematic pairs; Kinematic chain; Linkage, mechanism and structure; Mobility of mechanisms. Application of Kutzbach Criterion to Plane Mechanisms. Grubler's Criterion for Plane Mechanisms. Grashof 's law.

Inversions of Mechanisms: The four-bar chain; Mechanical advantage; Transmission angle; The slider-crank chain; Double slider-crank chain.

Employability

Employability

UNIT-II

Mechanism with lower pairs: Pantograph – straight line motion mechanisms – exact straight line motion mechanisms- Peaucellier mechanism, Approximate straight line motion mechanisms-Watt mechanism. Condition for correct steering-Davis & Ackerman's steering gear mechanisms.

Hooke's joint: Ratio of shaft velocities – maximum and minimum speed of driven shaft – condition for equal speeds – Angular acceleration of driven shaft – Double Hooke's joint.

Employability

Employability

UNIT – III

Velocity Analysis: Relative velocity method – velocity of point on a link- application of relative velocity method to simple mechanisms – rubbing velocity of a joint – Instantaneous centre method –body centrode and space centrode - velocity of point on a link by Instantaneous centre method, location of Instantaneous centre - three centres in line theorem and application of the method for simple mechanisms.

Employability

Acceleration Analysis: Acceleration diagrams of a link - acceleration diagrams for simple mechanisms-coriolis component of acceleration - acceleration diagram for slotted lever quick return mechanism- Klein's Construction.

Employability

UNIT -IV

Cams: Classification of followers and cams – terms used in radial cams – displacement, velocity and acceleration diagrams when the follower moves with uniform velocity, uniform acceleration and retardation, simple harmonic motion – construction of cam profiles.

Employability

Cams with specified contours: Tangent cam with roller follower – circular arc cam with flat faced follower.

Employability

UNIT-V

Toothed gearing: Classification of toothed wheels – terms used in gears - law of gearing – velocity of sliding of teeth – forms of teeth – Cycloidal and involute teeth– length of path of contact-arc of contact– contact ratio- interference in involute teeth - minimum number of teeth to avoid interference.

Gear trains:-Simple, compound and reverted gear trains – epicyclic gear train – velocity ratio of epicyclic gear train-sun and planet wheels – torques in epicyclic gear train-Differential of an automobile.

Emloyability

TEXT BOOKS:

1. Theory of Machines, S. S. Rattan ,3rd edition, McGraw-Hill Publications, New Delhi.
2. Theory of Machines, Thomas Bevan 3rd edition, CBS Publishers & Distributors, New Delhi.

REFERENCES:

1. Theory of Machines and Mechanisms, Shigley J. E. and John Joseph Uicker, 2nd edition McGraw-Hill international edition.
2. Theory of Machines, Dr.R.K. Bansal & Dr. J.S. Brar, 5th edition, Laxmi publications(P) LTD, New Delhi.
3. Theory of Machines, R.S.Khurmi & J.K.Gupta, 14th edition, S Chand & CO Ltd Publisher.
4. Mechanism and Machine Theory, J. S. Rao and R. V. Dukkipati, 2nd edition New Age International.

WEB REFERENCES:

1. www.mekanizmalar.com
2. www.museum.kyoto-u.ac.jp
3. Makezine.com

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

MANUFACTURING TECHNOLOGY-II

Course Code: MEC225 **L T P C**
4 0 0 3

Course Objective:

To make the students acquainted with the basic concepts of metal cutting, tool nomenclature, standards and tool performance. Further giving them an overall idea of constructional features of different machine tools such as lathe, drilling, milling, shaping, broaching and grinding and parameters related to the machining processes. The course further deals with non-conventional machining process and their relative advantages over conventional machining processes.

Course Outcomes:
Students will able to:

CO-1	Obtain knowledge on metal cutting tools, cutting parameters, chip formation and other variables influencing metal cutting.
CO-2	Acquire the knowledge of cutting tool's geometry, tool life and metal cutting economics
CO-3	Understand the construction, working and various work and tool holding attachments of machine tools like lathe, shaping, planning, slotting and drilling, boring, milling and broaching machines.
CO-4	Understand the construction, working of various abrasive machining processes and their applications in generating fine surface textures.
CO-5	Understand the principle and working of various nontraditional machining processes and their applications.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

COURSE OUTCOMES	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		**3**	**3**	**3**	**2**			**1**	**2**		**1**	
CO2	**3**		**3**	**3**	**2**	**1**		**1**	**2**		**1**	
CO3	**3**		**3**	**3**	**2**	**1**		**1**	**2**		**1**	
CO4	**2**	**3**	**3**	**3**	**1**			**1**	**2**		**1**	
CO5	**2**		**3**	**3**	**3**			**1**	**2**		**1**	

Course Outcomes	PSO1	PSO2
CO-1	2	3
CO-2	2	3
CO-3	2	3
CO-4	2	3
CO-5	1	3

UNIT-I

Mechanics of Metal Cutting:

Classification of machining processes, machine tools, cutting conditions, cutting parameters, production of geometrical shapes, types of chips, orthogonal and oblique cutting, forces in metal cutting, measurement of cutting forces – Dynamometers, Merchant circle diagram, shear angle, velocity relationships, specific cutting energy, stress and strain in chip.

Employability

UNIT –II

Employability

Cutting Tool & Tool Life

Friction in metal cutting, temperature in metal cutting, measurement of interface temperature, tool wear, tool life, tool failure, cutting fluids, machinability, surface finish, economics of machining, geometry of single-point (ASA, ORS (ISO Old) & NRS (ISO New) systems) and multi-point cutting tools, tool materials, kinematics of machine tools.

Employability

UNIT-III

Machine Tools (lathe, shaping, planning, slotting, drilling, boring, milling and broaching machines)

Introduction, working principle and functions, classification, construction, kinematic system, work holding, tool holding devices, attachments, operations, cutting tools and their nomenclature, comparison's, cutting parameters, machining time, forces on cutting tool, power consumed, reaming – cutting tools, operations and their applications, systems of measurement for hole location in boring machines and indexing methods in milling machines.

Employability

UNIT-IV

Grinding and Abrasive machining processes

Working principle of grinding machines, merits and de-merits, types of abrasives, bond

Employability

materials, grit grade and structure of grinding wheels, specifications of grinding wheels, wheel shapes and sizes, selection of grinding wheels. Classification of grinding machines, work holding devices, grinding fluids, grinding wheel, cutting parameters and machining time.

Finishing Operations – lapping, honing, super finishing, polishing, burnishing, buffing, tumbling, abrasive belt grinding.

UNIT-V

Non-Traditional Machining Processes
Introduction, classification, ultrasonic machining (USM), abrasive jet machining (AJM), electro discharge machining (EDM), laser beam machining (LBM), electron beam machining (EBM), electro chemical machining (ECM), and chemical milling (machining).

Employability

Text Books:

1. Fundamentals of Metal Machining and Machine Tools by Geoffrey Boothroyd, International Student Edition, Mc Graw-Hill Book Company.
2. Workshop Technology (Machine Tools) Vol II, (10th Edition) by B.S.Raghu Vamshi, Dhanpat Rai & Co (P) Ltd.

Reference books:

1. Production Engineering by P.C. Sharma, S. Chand and Company
2. Metal cutting and Machine Tool Engineering, Pakirappa, Durga Publishing House.
3. Metal Cutting Principles by M.C. Shaw, MIT Press, Cambridge.
4. Advanced Methods of Machining by J. A. Mc Geough, Chapman & Hall Publishers.
5. Metal Cutting-Theory and Practice by Amitabha Bhattacharya, Central Book Publishers.

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

MACHINE DRAWING

Course Code: MEC226

L	T	P	C
1		3	3

Pre- Requisite: Engineering Drawing

Course Objectives:

Introducing the practice of representing the inner details of machine elements through sectional views. Similarly introducing screw threads, screwed fasteners and riveted joints with their standard empirical formulae through drawings and further extending this to the drawing of temporary fasteners like Keys, Cotter-joints, Pin-joints, couplings, shaft bearings, machine elements and their assembly drawings. The course also includes the introduction to limits, fits, tolerances and surface roughness which form a pivotal role in production drawings.

Course Outcomes:

Students will be able to

CO-1	Understand and draw the orthographic views, isometric views and sectional views of mechanical components.
CO-2	Draw various thread profiles, Screwed fasteners, locking arrangements, foundation bolts and riveted joints.
CO-3	Draw various temporary fasteners such as cotter joints, pin joints and couplings.
CO-4	Draw Assembly drawings of various engine components and machine tool components.
CO-5	Draw the production drawings indicating limits, geometrical tolerances and surface roughness and also prepare process sheets.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	1	2	3	1	3	-	-	-	-	1	-	1
CO-2	1	2	3	1	2	-	-	-	-	-	-	-
CO-3	1	2	3	1	2	-	-	-	-	-	-	-
CO-4	1	3	3	2	3	-	-	-	-	-	-	1
CO-5	1	3	3	2	3	-	-	-	1	1	-	1

Course Outcomes	PSO1	PSO2
CO-1	2	3
CO-2	2	3
CO-3	2	3
CO-4	2	3
CO-5	2	3

UNIT-I

Introduction to machine drawing and production drawing. Orthogonal views, Half sectional and full sectional views of machine parts

Skill development/ Employability

UNIT-II

Skill development/ Employability

Screw Threads, Screw Fasteners, Locking arrangements, Foundation bolts and Riveted joints using standard Empirical formulae

Skill development/ Employability

UNIT-III

Keys, Cotter-joints, Pin-joints, Shaft couplings: Box and split muff couplings, Flanged couplings, Flexible couplings, Universal and Oldham couplings

UNIT-IV

Skill development/ Employability

Drawings of assembled views for the part drawings of the following
a) Engine parts : Stuffing box, Cross head, Eccentric, Petrol Engine connecting rod
b) Other machine parts : Screws jack, Shaper tool head slide, Tailstock, Clutch
c) Valves : Gate valve, Non-Return valve, feed check valve and air cock

UNIT-V

Skill development/ Employability

Limits, Fits and Tolerances, Geometrical Tolerances, Surface Roughness
Production drawings of Spur, Bevel and Helical gears. Swivel bracket, Crank, Revolving Centre.
Preparation of process sheets

Text Books:

1. Machine Drawing by N. D. Bhatt, V. M. Panchal, Charotar Publishing House Pvt. Ltd
2. Production Drawing by K.L.Narayana, P.Kannaiah and K.VenkataReddy, New age international Publishers

Reference:

1. Textbook of Machine Drawing by K.C. John, PHI Learning
2. Machine Drawing by K.L Narayana, P. Kannaiah and K. Venkata Reddy, New age international Publishers
3. A Text Book of Machine Drawing by Dr. R.K. Dhawan, S.Chand Publications

Web Reference:

1. http://www.rajaroy.co.in/p/machine-drawing.html
2. http://nptel.ac.in/syllabus/112106075/

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

MANUFACTURING TECHNOLOGY – I LAB

Course Code: MEC227

L	T	P	C
0	**0**	**3**	**2**

Course Objective:

To demonstrate manual arc welding through the practice of fabricating various weld joints and using NDT methods to identify the defects. The course also gives an opportunity to the student in preparing moulds for different patterns and further for determining the characteristics of moulding sand.

Course Outcomes:

The students will be able to:

CO-1	Prepare sand mould for different patterns in casting process.
CO-2	Evaluate the properties of moulding sand to check its suitability.
CO-3	Gain proficiency in manual arc welding process by fabricating a spectrum of weld joints.
CO-4	Identify the defects in welding through NDT.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

COURSE OUTCOMES	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**			**3**	**2**	**3**		**2**	**3**		**3**	
CO2	**2**			**3**	**2**	**3**		**2**	**3**		**3**	
CO3	**2**			**3**	**2**	**3**		**2**	**3**		**3**	
CO4	**2**			**3**	**2**	**3**		**2**	**3**		**3**	

Course Outcomes	PSO1	PSO2
CO-1	1	1
CO-2	1	1
CO-3	1	1
CO-4	1	1

List of Experiments:

1) Preperation of sand mould for solid flange
2) Preperation of sand mould for stepped cone pulley
3) Preperation of sand mould for hallow pipe
4) Moisture content test
5) Clay content test
6) Green compression and Shear Strength test
7) Sieve analysis
8) V-Butt joint in manual arc welding
9) Corner weld joint in manual arc welding
10) Double lap weld joint in manual arc welding
11) Die Penetrant test
12) Permeability test

Employability

References: Manufacturing Technology, P.N.Rao, Mc Graw-Hill Book Company.

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

Course Code: MEC228	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

Course Objectives:

To make students learn to calibrate wattmeter and energy meter and conduct a practical analysis of linear circuits by using mesh and nodal analysis. Further the student also learns to predict the characteristics of DC & AC machines and rectifiers.

Course Outcomes:

Students will be able to:

CO1	Analyze linear circuits by using network theorem.
CO2	Predict the performance characteristics of DC machines and induction motor
CO3	Predict the regulation of single phase transformer & alternator.
CO4	Observe the performance of rectifiers.

Mapping of course outcomes with program outcomes

COURSE OUTCOMES	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1								**2**	**1**		**1**	**1**
CO2	**1**			**1**				**2**	**1**		**1**	**1**
CO3	**1**			**1**				**2**	**1**		**1**	**1**
CO4				**1**				**2**	**1**		**1**	**1**

Course Outcomes	PSO1	PSO2
CO-1	0	1
CO-2	1	1
CO-3	1	1
CO-4	0	1

List of Experiments: (Any 10 experiments).

1. Study and Calibration of wattmeter
2. Study and calibration of energy meter
3. Measurement of armature resistance, field resistance and filament lamp resistance.
4. Verification of KCL and KVL.

5. Superposition theorem.
6. Parameters of a choke coil.
7. O.C and S.C. tests on transformer
8. Load test on D.C. shunt machine.
9. O.C. test on D.C. separately excited machine.
10. Swinburne’s test.
11. 3 phase induction motor load test.
12. Regulation of alternator by EMF method.
13. Half wave rectifier.
14. Full wave rectifier

OPEN ELECTIVE-I (A) **ROBOTICS**	
MEC 311	**Credits:3**
Instruction : 3periods & 1Tut/Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Prerequisites:

Engineering mathematics, Engineering mechanics.

Course objective:

To familiarize the students with the automation and brief history of robot development, impart knowledge on kinematics of robots, robot end effectors and their design, various sensors and their applications in robots and further acquaint them with robot programming methods & languages of robot.

Course outcomes:

By the end of the course, the student will be able to:	
CO-1	Understand the definition of a robot & its historical development and various components of it.
CO-2	Apply the concepts of kinematic and dynamic analysis for the design of robot manipulators.
CO-3	Determine the trajectory planning of robotic system.
CO-4	Describe different mechanical configurations of robot manipulators.
CO-5	Apply the principles of various Sensors and their applications in robots and understand the programming methods & various languages of robots.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	3	1	3	2	1	1	1	1	2	1	2	2	2
	2	3	3	3	2	2	1	1	1	2	2	1	1	3	2
	3	3	1	1	1	1	1	1	1	1	2	1	1	3	1
	4	2	1	3	2	1	1	1	1	2	1	2	2	2	2
	5	3	2	3	3	3	2	3	2	2	2	1	2	3	2

SYLLABUS **Periods(L+T)**

UNIT-I(8+0)

Introduction

Background- historical development- robot arm kinematics anddynamics- manipulator trajectory planning and motion control- robot sensing- robot programming language- machine intelligence.

Employability

UNIT-II **(12+4)**

Robot Arm kinematics: Introduction – direct kinematics problem, rotation matrices, homogeneous coordinates and transformation matrix, links, joints and their parameters- inverse kinematics solution.

Robot Arm Dynamics: Introduction – Lagrange-Euler formulation- Newton-Euler formation - generalized D'Alembertsequations of motion.

Employability

Emloyability

UNIT-III(8+2)

Planning of Manipulator Trajectories

Introduction-general considerations on trajectory planning- joint interpolated trajectories- planning of manipulator Cartesianpath trajectories.

UNIT-IV **(10+2)**

Control of Robot Manipulators

Introduction – control of the puma robot arm- computed torque technique- near minimum time control- variable structure control- nonlinear decoupled feedback control- resolved motion control- adaptive control.

Emloyability

Emloyability

UNIT-V **(10+4)**

Sensing: Introduction-range sensing-proximity sensing- touch sensors- force and torque sensing.

Low-Level Vision: Introduction –image acquisition- illumination techniques- imaging geometry- some basic relationship between pixels – preprocessing.

Robot Programming Languages: Introduction- AL, AML, RAIL, RPL, VAL, Demonstration of points in space: Continuous path (CP), Via points (VP), Programmed points (PP).

Emloyability

Text Books:

1. King-Sun Fu, R.C. Gonzalez and C.S.George Lee,*Robotics Control Sensing Vision And Intelligence*, 1st edition,Mcgraw-Hill Education International Ed (1987)
2. **John J. Craig,*Introduction to Robotics - Mechanics and Control,*** 3rd edition, **Addison-Wesley Longman Inc., 1999.**

Reference Books:

1. Mikell P. Groover,Mitchell Weiss,Roger N. NagelNicholas G. Odrey, *Industrial Robotics-Technology, Programming, and Applications*, 2nd edition,McGraw-Hill Higher Education©1986
2. Lung-Wen Tsai,*Robot Analysis- The Mechanics of Serial and Parallel Manipulators*,JohnWiley& Sons,1999

3.Mittal &Nagrath, *Robotics and Control*, 1st edition,Tata McGraw-HillEducation, 2003

Web resources:

1. http://nptel.ac.in/courses/112101098
2. nptel.ac.in/courses/112101099/
3. www.nptelvideos.in/2012/12/robotics.html
4. https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/
5. https://www.doc.ic.ac.uk/~ajd/**Robotics**/**RoboticsResources**/lecture1.pdf
6. http://students.iitk.ac.in/roboclub/lectures/Introduction%20to%20Robotics.pdf

OPEN ELECTIVE-I (B) **COMPUTER AIDED DESIGN**	
MEC 311	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Course objectives

To enable students in using computers for design, analysis and optimization of machine elements and synthesis. Further educate them on different modeling techniques and writing algorithms for various design problems using CAD.

Course outcomes

By the end of the course, the student will be able to:	
1.	Understanding the usage of computer peripherals and 2D entities in drawing Machine Elements.
2.	Evaluate the difference between wireframe model, surface model and solid model.
3.	Analyze the behavior of a CAD system using FEM.
4.	Design the algorithms and implement them in solving mechanical design problems.
5.	Apply the technique of Artificial Intelligence to design problems using CAD.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	1	1	1	3	1	1	1	1	1	1	1	2	2
	2	3	1	3	2	3	1	1	1	1	1	1	1	2	3
	3	3	3	3	3	3	1	1	1	1	1	1	1	3	3
	4	2	2	1	1	3	1	1	1	1	1	1	1	2	1
	5	1	1	1	2	3	1	1	1	1	1	1	1	1	1

SYLLABUS **Periods (L+T)**

Unit-I **(12+0)**

Fundamentals of CAD

Emloyability

Introduction - The design process - Application of computers for design - Operating systems - Hardware in CAD: The design work station - I/O Devices - CAD system configuration - Creating database for manufacturing - Benefits of CAD.

Unit-II Emloyability **(12+2)**

Computer Graphics

Interactive Computer Graphics - Graphic display devices- Graphics system- Graphics standards - Graphical user interface- Transformation systems- windowing - clipping - 2D and 3D transformations - Linear transformation- Display files for 3D data - Geometric Modeling - Modeling Techniques - Wire frame Modeling - Surface Modeling - 3 D Solid Modeling.

Unit-III Emloyability **(9+3)**

CAD approach to Finite Element Analysis

Introduction to Finite Element Analysis - CAD techniques to finite element data preparation- Automatic mesh generation- presentation of results - 3-dimensional shape description and mesh generation- CAD applications of FEM.

Unit-IV Emloyability **(10+4)**

CAD approach to design problems and exposure to CAD packages

Introduction to simple machine elements - Analysis of cross sectional area, centroid & moment of inertia- Kinematics of crank- slider mechanism and other simple design applications using flow charts and algorithms, Introduction to CAD packages like ANSYS, NASTRON, NISA-II.

Unit-V Emloyability **(8+0)**

Artificial Intelligence:

Introduction to Artificial Intelligence - Applications of AI in design and CAD.

Emloyability

Text Books:

1. M.P.Groover & E.W.Zimmer, *CAD/CAM- Computer Aided Design & Manufacturing,* Prentice Hall, Inc, 2014.
2. Dr.Sadhu Singh,*Computer Aided Design and Manufacturing*, Khanna Publishers, 2000.

Reference Books:

1. V.Ramamurthi*, Computer Aided Design in Mechanical Engineering,* 3rd edition, Tata McGraw-Hill, 1989
2. Y.C.Pao,*Elements of Computer Aided Design & Manufacturing,* John Wiley & Sons Australia, Limited, 1992
3. S. Ghosal,*Computer-Aided Analysis & Design*, Prentice-Hall Of India Pvt. Limited, 2004

HYDRAULIC MACHINERY AND SYSTEMS	
MEC 312	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Fluid mechanics, Engineering mathematics, Engineering mechanics.

Course Objectives:

To make the students apply the knowledge of basic sciences and engineering to evaluate the forces exerted by a jet of fluid on vanes of different shapes and further apply this knowledge in the study of hydraulic machinery like turbines, pumps etc.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Analyze the forces exerted by a jet of fluid on vanes of different shapes, either stationary or moving.
2.	Study and analyze the construction features and working principles of different classes of hydraulic turbines.
3.	Analyze the performance characteristic curves of hydraulic turbines.
4.	Distinguish between different classes of pumps, their construction features and further analyze their performance.
5.	Understand the working principles of various hydraulic systems, hydraulic control systems and fluidics.

Mapping of Course Outcomes with Programme Outcomes.

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	2	2	1	1	1	1	1	1	1	1	1	2	2
	2	2	1	1	1	1	2	2	1	1	2	1	1	2	1
	3	1	1	1	2	1	1	1	1	1	1	1	1	1	1
	4	2	2	1	2	1	2	1	1	1	1	1	1	2	2
	5	1	2	3	2	1	2	1	1	2	2	2	2	1	2

SYLLABUS **Periods**

(L+T)

UNIT-I **(9+3)**

Impact of jet and jet propulsion

Impact of jet on stationary surfaces, Impact of jet on hinged surfaces, Impact of jet on moving vanes-Tangential and radial flow, Jet propulsion.

UNIT-II **(10+5)**

Employability

Hydraulic Turbines

General layout of hydro power plant, heads and efficiencies of turbines, classification of turbines.

Employability

Impulse turbine: Pelton turbine-components, work and efficiencies.

Reaction turbine: Francis turbine-construction features,work and efficiencies, draft tube theory, Axial flow turbine – Kaplan turbine-constructional features, work and efficiencies.

UNIT-III **(7+2)**

Performance of turbines

Employability

Unit quantities and their significance, specific speed of turbines, performance characteristic curves-constant head, constant speed and constant efficiency curves, model testing of turbines, cavitation in turbines, selection of turbines, governing of turbines.

UNIT-IV **(10+5)**

Pumps

Employability

General: Classification of pumps-positive displacement and non-positive displacement.

Reciprocating Pumps: Main parts, Classification, work done by pumps, coefficient of discharge, slip, negative slip, Indicator diagram, acceleration head and its effects in suction and delivery pipes, effect of friction, air vessels-construction, working, functions and effect of air vessels on discharge, pressure head, work, indicator diagram, maximum speed and work saved against friction.

Centrifugal Pumps: Components and working principle, priming of centrifugal pumps, work done by impeller, head, losses and efficiencies, minimum starting speed, specific speed, multi stage pumps, performance of pumps-characteristic curves, NPSH, cavitation.

Employability

UNIT-V **(8+1)**

Hydraulic systems & Fluidics

Employability

Hydraulic accumulator-single and differential types, hydraulic intensifier, hydraulic press, hydraulic crane, hydraulic ram, hydraulic jack, hydraulic coupling and torque converter.

Hydraulic control systems: components and symbols, types of control systems-closed loop and open loop, control methods, applications of control systems in turbines and machine tools.

Fluidics: Introduction, fluid amplification, types of amplifiers

Employability

Text Books:

1. P.N. Modi & S.M. Seth, *Hydraulics and fluid mechanics: including hydraulic machines*, 18th edition, Standard Book House 2011.
2. Jagadish Lal ,*Hydrualic Machines,* 6th edition, Metropolitan Book Co., New Delhi 2007.

Reference Books:

1. Dr.R.K.Bansal ,*Fluid Mechanics and Hydraulic machinery* 9th edition Laxmi publications 2017.
2. T.R Banga & S.C. Sharma *Hydraulic machines*, Khanna publishers

Web Resources:

1. http://nptel.ac.in/courses/112104117/26
2. http://nptel.ac.in/courses/112104117/33

ENGINEERING THERMODYNAMICS - II	
MEC 313	**Credits : 4**
Instruction : 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Engineering Mathematics, Engineering Mechanics, Basic Thermodynamics

Course Objective:

To acquaint the student with the fundamentals of pure substance, property variation due to phase change and apply these basics in the study of vapor power cycles, refrigeration cycles and thermal power plant equipments like turbines and condensers.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Identify the phase change process of pure substance on property plots and determine the steam properties using steam tables and Mollier chart.
2.	Analyze the working of a simple vapor power cycle and further apply thermodynamic techniques to enhance its performance.
3.	Differentiate the various classes of nozzles and condensers, gauge their performance and further design or select suitable nozzles and condensers for a specific application.
4.	Comprehend the functioning of different kinds of steam turbines, compounding techniques and also evaluate their performance.
5.	Understand the various refrigeration cycles, their applications, analyze their performance and further get acquainted with psychrometric terms and processes.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	2	1	2	1	1	1	1	1	1	1	1	2	2
	2	3	3	3	2	1	2	1	1	1	2	2	2	3	2
	3	3	3	3	2	1	1	1	1	2	2	1	1	3	2
	4	3	3	2	2	1	1	1	1	2	2	2	2	3	2
	5	2	1	2	1	1	2	2	2	2	2	2	1	2	2

SYLLABUS **Periods (L+T)**

UNIT-I **(12+3)**

Properties of Pure Substance:

Definition of pure substance, phase change of a pure substance, property diagrams for phase change process- T-v, p-v, p-T, T-s, h-s (Mollier diagram), p-v-T surface of pure substance, formation of steam, important terms relating to steam formation, steam tables, external work done during evaporation, internal latent heat, internal energy of steam, entropy of water, entropy of evaporation, entropy of steam, thermodynamic process of steam-isobaric, isochoric, isothermal and isentropic, determination of dryness fraction-throttling calorimeter, separating and throttling calorimeter.

Employability

UNIT-II **(9+3)**

Vapor Power Cycles:

Simple steam power cycle, Rankine cycle, steam rate, heat rate and thermal efficiency, actual vapor cycle process, comparison of Rankine – Carnot cycles, mean temperature of heat addition, methods for improving efficiency of Rankine cycle - reheat cycle, ideal regenerative cycle, regenerative cycle, reheat-regenerative cycle, feed water heaters, characteristics of ideal working fluid, binary vapor power cycle.

Employability

UNIT-III **(12+3)**

Steam Nozzles: Types of nozzles- Flow through nozzles- Condition for maximum discharge- Nozzle efficiency- Super saturated flow in nozzles- Relationship between area velocity and pressure in nozzle flow- Under expansion & over expansion.

Steam Condensers: Introduction, vacuum, Classification of condenser Jet and surface condensers, Sources and effects of air leakage in condensers, Vacuum efficiency and Condenser efficiency, Determination of mass of cooling water.

Employability

UNIT-IV **(14+4)**

Steam Turbines: Introduction, classification of steam turbines, compounding of turbines & governing of steam turbines.

Impulse Turbines: Velocity diagrams and performance parameters, condition for maximum blade efficiency for single stage impulse turbine, velocity diagram for velocity compounded impulse turbine.

Reaction Turbines: Velocity diagram, degree of reaction, Parson's reaction turbine, condition for maximum blade efficiency of Parson's turbine.

Employability

Employability

UNIT-V **(12+3)**

Refrigeration: Fundamentals of refrigeration, refrigeration systems, Coefficient of performance, standard rating of refrigeration, air refrigeration systems- closed and open systems, reversed Carnot cycle, reversed Brayton cycle-Bell colemn cycle, vapor compression refrigeration system, T-s, p-h diagrams, factors effecting performance of vapor compression refrigeration system, simple Vapor absorption refrigeration system, properties of common refrigerants.

Psychrometry and air-conditioning: Psychrometric terms, psychrometric chart and psychrometric processes, air conditioning systems.

Text Books:

1. R. K. Rajput, *Thermal Engineering* 10th edition, Laxmi publication (P) Ltd. 2017.
2. VP Vasandhani and DS Kumar, *Treatise on Heat Engineering*, 4th edition, Metropolitan Book Co Pvt. Ltd. 2009.

Reference books:

1. P. K. Nag, *Basic and Applied Thermodynamics* 2nd edition, Tata McGraw Hill Education (P) Ltd. 2009.
2. Yunus A. Cengel and Michael A. Boles, *Thermodynamics, An Engineering approach* 8th edition, Tata McGraw Hill Education (P) Ltd. 2015.
3. R. Yadav, *Applied Thermodynamics* 6th edition, Central Publishing House, Allahabad. 2011.

Web resources:

1. http://nptel.ac.in/courses/112105123/
2. http://nptel.ac.in/courses/112104117
3. http://nptel.ac.in/downloads/112105129/

THEORY OF MACHINES - II	
MEC 314	**Credits : 4**
Instruction : 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites: Mathematics, Engineering Mechanics, Theory of machines-I

Course Objective:

To make the students understand the gyroscopic effect on vehicles, ships and aircrafts and design governors for specific application. The objective is also to enable students to perform dynamic and vibration analysis and solve balancing problems in practical applications.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Apply the knowledge of Gyroscopic Principle to aeroplane, ship, two wheelers and four wheelers and design Governors for a specific application.
2.	Perform static and dynamic analysis on slider crank mechanism and design flywheel for an IC engine.
3.	Solve rotating and reciprocating balancing problems in applications like shafts and Locomotives.
4.	Distinguish different classes of vibrations and further analyse longitudinal vibrations of single degree of freedom under undamped and damped conditions.
5.	Analyze free and forced transverse vibrations under different loading conditions and further study free torsional vibrations with single, two rotor, three rotor and geared system

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3	2	2	1	1	1	1	1	1	1	1	3	2
	2	3	3	2	2	1	1	1	1	1	1	1	1	3	2
	3	3	3	2	2	1	1	1	1	1	1	1	1	3	2
	4	3	3	2	2	1	1	1	1	1	1	1	1	3	2
	5	3	3	2	2	1	1	1	1	1	1	1	1	3	2

SYLLABUS **Periods (L+T)**

UNIT –I **(16+4)**

Gyroscope:

Gyroscopic torque, Gyroscopic effect on Aeroplanes, Ships. Stability of four wheeled and two wheeled vehicles.

Employability

Governors:

Types of governors, Watt, Porter and Proell governors, spring loaded governors – Hartnell, Sensitiveness of a governor, Hunting, Isochronism and Stability. Effort and Power of Governor, Controlling force (Porter and Hartnell governors).

Employability

UNIT – II **(16+4)**

Static and dynamic force analysis:

D'Alembert's principle, Equivalent offset inertia force, Static and Dynamic analysis of slider crank mechanism (Analytical/Graphical method), Engine force analysis, Dynamically equivalent system, inertia of connecting rod.

Employability

Turning moment diagrams:

Turning moment diagrams for I-C engines, fluctuation of energy, flywheels, and dimensions of flywheel rims.

Employability

UNIT –III **(10+5)**

Employability

Balancing of rotating masses:

Static and Dynamic Balancing of rotating masses, Balancing of several masses in different planes.

Balancing of reciprocating masses:

Balancing of uncoupled locomotives, Effects of partial balancing in locomotives- hammer blow, swaying couple, variation of tractive effort. Secondary balancing, Balancing of inline engines, Twin V-engine and Radial engines.

UNIT –IV **(7+3)**

Vibrations:

Definitions- Types of vibrations- Degrees of freedom.

Employability

Longitudinal vibrations:

Free longitudinal vibrations of systems having single degree of freedom- Equilibrium method- Energy method and Rayleigh's method, Inertia effect of spring. Damped vibrations, Logarithmic decrement, Forced vibrations with damping- Magnification factor, Vibration isolation and Transmissibility.

Employability

UNIT –V **(7+3)**

Transverse and Torsional vibrations:

Free transverse vibrations of shafts due to single concentrated load, uniformly distributed load and carrying several concentrated loads- Dunkerley's method and Energy method. Whirling of shafts.

Free torsional vibrations (single, two rotor and three rotor system), Torsionally equivalent shaft, Geared system, Bifilar Suspension.

Employability

Text books:

1. S. S. Rattan, *Theory of Machines*, 4^{th} edition, McGraw-Hill Publications, New Delhi, 2014.
2. R.S.Khurmi & J.K.Gupta, *Theory of Machines*, 14^{th} edition, S Chand & CO Ltd Publisher, 2005.

Reference books:

1. Thomas Bevan, *Theory of Machines* 3^{rd} edition, CBS publishers & distributors, 2005.
2. P.L.Ballaney, *Theory of Machines and mechanisms*, 25^{th} edition, Khanna publishers, New Delhi, 2016.

Web Resources:

http://nptel.ac.in/courses/112101096/
http://nptel.ac.in/courses/112104114/

DESIGN OF MACHINE ELEMENTS – I	
MEC315	Credits :- 4
Instruction : 4Periods & 1 Tut/week	Sessional marks :- 40
End Exam : 3hrs	End Exam marks :- 60

Pre requisites: - Engineering Mathematics, Engineering Mechanics & Strength of materials.

Course Objective:

This course introduces the design philosophy at basic level, engineering materials, types of loading and different failure criteria. Further the student will get acquainted with the design of threaded and welded joints and basic machine elements like shafts, keys, couplings, springs etc.

Course Outcomes:

By the end of the course student will be able to:	
1	Understand and apply the concepts of basic engineering and engineering materials to design a competitive product by following all the design considerations.
2	Analyze the type of failure and determine geometric dimensions and stresses on mechanical components subjected to both static and fluctuating loads.
3	Design threaded and welded joints, subjected to eccentric & fluctuating loads.
4	Evaluate stresses induced in shafts, keys, and couplings and design these components suitable to automobile applications.
5	Design various types of springs subjected to static and fluctuating loads.

Mapping of course outcomes with programme outcomes:-

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	2	3	2	2	1	1	1	1	1	1	1	2	2
	2	2	3	2	2	2	1	1	1	1	1	1	1	2	2
	3	2	2	3	2	2	1	1	1	1	1	1	1	2	3
	4	2	2	3	2	2	1	1	1	1	1	1	1	2	3
	5	2	2	3	2	2	1	1	1	1	1	1	1	2	3

SYLLABUS **Periods (L+T)**

UNIT-1 **(8+2)**

Introduction to Mechanical engineering design: Traditional design methods, design process, Problem formulation, Design considerations, manufacturing considerations, engineering materials, Mechanical properties, BIS designation of steels.

Emloyability

UNIT-II **(15+5)**

Design against static loads: Modes of failure, Factory of safety, Axial, bending and torsional Stresses, Cotter joint, Knuckle joint, Static failure theories.
Design against fluctuating load: Stress concentration, Methods of reducing stress concentration, Fatigue, Endurance limit, S-N Curve for steels, Soderberg, Goodman and modified Goodman diagrams, cumulative damage in fatigue, Fatigue design under combined stresses.

Emloyability

Emloyability

UNIT-III **(10+5)**

Threaded joints: Forms of threads, ISO metric screw threads, eccentrically loaded bolted joints, Torque requirement for bolt tightening, Fluctuating loads on bolted joints, bolt of uniform strength.Power screws, Force analysis on screw jack, Collar friction.
Welded joints: Types of weld joints, strength of butt and fillet joints, axially loaded unsymmetrical welded joints, eccentrically loaded welded joints, and welded joints subjected to bending moment, welding inspection.

Emloyability

UNIT-IV **(10+5)**

Emloyability

Shafts & keys: Types of shafts, selection of material, shafts design on strength basis & torsional rigidity basis, Design of hollow shafts, ASME codes for shaft design.
Types of keys, Design of square and flat key, Kennedy key, Splines.
Couplings
Types of couplings, selection of material, Rigid flange couplings, Flexible couplings, universal coupling.

Emloyability

UNIT-V **(10+5)**

Spring Design
classification of springs, spring materials, style of spring end, Design of helical Compression springs, helical extension springs, torsion springs. Leaf springs, Equalized stress in spring leaves. Surge in springs, nipping and shot peening.

Emloyability

Text Books:

1. V.B.Bhandari, *Design of Machine Elements* 3rd edition, , Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2016.
2. Design data book, PSG College of technology, Coimbatore, 2011.

Reference Books:

1. R.K. Jain, *Machine Design*, 9th edition, Khanna Publications.
2. Pandya and Shah, *Machine Design*, 20th edition , Charotar publishing house Pvt. Ltd. 2015.
3. R.L.Norton, *Machine design, an integrated approach*, 2nd edition, Pearson Education 2014.
4. Joseph Edward Shigley, *Mechanical Engineering design*, 9th edition, McGraw Hill Company, 2011.

Note: Design data book is allowed in examinations.

Web Resources:

1) http://www.nptelvideos.in/2012/12/design-of-machine-elements.html
2) https://www.machinedesignonline.com/
3) http://nptel.iitg.ernet.in/
4) https://vtechworks.lib.vt.edu/handle/10919/34877

FLUID MECHANICS AND MACHINERY LAB	
MEC 316	**Credits : 2**
Instruction : 3 Periods /Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Course objective:

The methodology involved in calibrating flow measuring devices such as venturimeter, orificemeter, orifice and V-notch will be demonstrated. Further the performance of different turbo-machinery under varying operating conditions will be evaluated.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Verify the veracity of Bernoulli’s theorem.
2.	Calibrate flow measuring devices such as venturimeter, orificemeter, orifice and V-notch.
3.	Determine the friction factor and minor losses in pipes.
4.	Determine the force exerted by jet on vanes of different configurations and compare with theoretical values.
5.	Evaluate the performance of different classes of turbines and pumps under varying operating conditions.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1			2					1	1		1	1	1
	2	2	2	2	2		2	1	1	1	1	1	1	2	2
	3	1	1	1	2	1	1	2	1	1	1	2	1	1	1
	4	2	1	2	1		1	1		1	1	1	1	2	1
	5	2	2	2	2		2	2	1	2	2	2	2	2	2

List of Experiments:

1. Verification of Bernoulli’s theorem
2. Determination of coefficient of discharge of
   a. Rectangular notch (or)
   b. Triangular notch
3. Determination of coefficient of discharge of
   a. Orifice (or)
   b. Mouthpiece

4. Calibration of flow meters
    a. Venturimeter and
    b. Orificemeter
5. To demonstrate and study different flow regimes using Reynold's experimental setup
6. To determine the head losses for flow through pipes and further obtain friction factor
7. Impact of jet on a
    a. Flat vane (or)
    b. Curved vane
8. To draw the performance characteristic curves for
    a. Pelton turbine and
    b. Francis turbine
9. To draw the performance characteristic curves for Centrifugal pump
10. To draw the performance characteristic curves for reciprocating pump
11. To determine the efficiency of a Hydraulic ram
12. To draw the pressure distribution and determine the coefficient of drag for flow over
    a. Cylinder (or)
    b. An aero foil

Skill Development

Reference Book:

Ch. Ratnam & K. Arun vikram, *Fluid Mechanics and Machinery*, 2nd revised edition, I K International Publishing House Pvt. Ltd. 2011.

MANUFACTURING TECHNOLOGY LAB - II	
MEC 317	**Credits:2**
Periods: 3 / week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks: 50

Course Objective:

To Study and practice the various operations that can be performed on lathe and also to investigate the influence of machining parameters on chip formation, cutting forces and shear angle on different machine tools.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Perform lathe operations such as facing, turning, taper turning, etc.
2.	Study and differentiate the formation of variety of chips obtained by varying the machining parameters on different materials.
3.	Analyze the influence of cutting parameters on cutting forces in machine tools like lathe, drilling & milling machines.
4.	Assess the influence of tool geometry and cutting parameters on shear angle in both turning and shaping operations.
5.	Measure the temperature of cutting tool in machining processes.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**		1	1	2		1	1	1	1	1	1	1	1	1
	2	1	1	1	2		1	1	1	1	1	1	1	1	2
	3	1	2	1	3	2	1	1	1	1	1	1	1	2	2
	4	1	2	1	3					1	1	1	1	2	2
	5	1	1	2	2	1	1	1	1	1	1	1	1	1	2

List of Experiments

1. Step turning on Lathe.
2. Taper turning and knurling on Lathe.
3. Thread cutting and forming on Lathe.
4. Step turning and knurling on a round bar using Capstan Lathe.
5. Grinding of a single point cutting tool and measurement of tool signature.
6. Study of chip formation in metal cutting.
7. Measurement of cutting forces on lathe.
8. Measurement of torque and thrust on drilling machine.
9. Measurement of cutting forces on milling machine.
10. Measurement of shear angle on Lathe.
11. Measurement of shear angle on Shaper.
12. Measurement of cutting tool tip temperature on Lathe.

Employability

Reference Book:

P.N.Rao, *Manufacturing Technology*, Volume-2, 3rd edition, McGraw-Hill Book Company, 2013.

MANUFACTURING TECHNOLOGY – III	
MEC 321	**Credits:3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisite: Manufacturing Technology-I&II**.**

Course Objective:
The course aims at demonstrating the basic principles of NC, CNC, DNC and FMS, developing code for CNC and acquainting with various measuring instruments. The objective is also to make them learn acceptance tests used for various machine tools.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Understand automated manufacturing methods.
2.	Write program for automated manufacturing for NC , CNC & DNC machine tools.
3.	Familiarize themselves with various measuring instruments and comparators.
4.	Identify and measure the basic parameters of gears and screws.
5.	Understand about various surface texture identification techniques and acceptance tests on machine tools.

Mapping of course outcomes with program outcomes:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	1	1	1	1	2	3	2	2	1	3	3	1	1
	2	3	3	3	3	3	2	1	1	2	1	1	3	3	2
	3	3	2	2	2	2	2	1	1	2	2	1	2	2	2
	4	2	2	2	2	3	2	1	2	2	2	1	2	2	2
	5	2	2	2	2	3	2	1	2	2	2	2	2	2	2

SYLLABUS **Periods (L+T)**

UNIT-I **(15+0)**

Advanced Manfacturing

Numerical control, NC operation, Coordinate system, Data input devices, Data storage, Programme editing, Machining centres, Turning centres, Vertical turning centres, Milling centres, CNC and DNC,

Introduction to Robots, Flexile Manufacturing System, Steps toward automatic factory.

UNIT-II Employability **(10+5)**

Employability

CNC part programming

Manual Part Programming Designation of co-ordinate axes for CNC machines, Functions of machine control units, Tape format, Computer assisted part programming (using APT language). Exercises involving simple contours and positioning using Manual part programming and Computer Assisted part programming.

Employability

UNIT-III **(8+2)**

Measurements Straightness measurement, Slip gauges, , Squareness testing, Optical bevel protractor, Sine bar, Angle gauges, Precision level, Autocollimator, Angle dekkor, Optical dividing heads and rotary tables, Flatness measurement, Roundness measurement. Co-ordinate measuring machines. Employability

Comparators -- Twisted strip mechanical comparator, Optical lever comparator, Optical projector, Electric comparator, Pneumatic comparator

Employability

UNIT-IV **(8+2)**

Measurement of Mechanical Components

Measurement of screw threads, major diameters, Minor diameters and effective diameter, Pitch, Limit gauges for internal and external threads, Tool maker's microscope

Measurement of spur gears, pitch, profile, lead, backlash, tooth thickness.

UNIT-V **(8+2)**

Surface texture: Parameters, sampling length, Specification, Order of geometrical irregularties, Stylus instruments Profilometer, CMM, Tomlinson Surface meter and Taylor-Hobson Talysurf for surface roughness measurement . Employability

Acceptance tests on machine tools: Lathe, Milling machine, Radial drill, Laser equipment.

Text Books:

1. R.A.Lindberg, *Process & Materials of Manufacture*, 4th edition, Prentice-Hall of India, New Delhi.
2. I.C.Gupta, *A Text Book of Engineering Metrology*, Dhanpat Rai & Sons, Delhi.
3. T.K.Kundra, P.N.Rao & N.K.Tewari, *CNC and Computer Aided Manufacturing*, 1st edition, Tata McGraw-Hill Publishing Company Ltd, Delhi, 1998 .

References:

1. *A.S.T.M.E., Hand book of Industrial Metrology*, Prentice-Hall of India, New Delhi.
2. *A.S.T.M.E., Hand book of Manufacturing Engineering*.
3. L.E.Doyle, *Manufacturing Processes & Materials for Engineers*, Prentice-Hall of India, New Delhi.
4. G.S.sawhney, *Fundamentals of Computer Aided Manufacturing*, 2nd edition, I.K Publishers, 2011.
5. Chennakesave R.Alavala, *CAD/CAM Concepts and Applications*, PHI publishers.

Webresource:
www.wri.org.in

INDUSTRIAL ENGINEERING AND MANAGEMENT	
MEC 322	**Credits:3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisite: Basic Mathematics.

Course Objective:

The course is indented to impart knowledge on the basics of management principles, fundamentals of production planning and control, work study and quality assessment techniques.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Understand the concepts of management, administration and the evolution of management thoughts.
2.	Understand the fundamentals of production planning and control and further solve Problems related to production scheduling.
3.	Apply work measurement techniques and methods study procedures for productivity improvement.
4.	Categorise loads, select appropriate material handling equipment, understand different purchasing techniques, maintaining store records and further get familiarised with factories acts.
5.	Construct various control charts for the variables, attributes and explain various sampling methods and OC curves.

Mapping of course outcomes with program outcomes:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	1	1	1	1	2	1	2	3	3	2	3	2	2
	2	1	3	3	2	1	1	1	2	1	2	1	1	3	2
	3	2	3	2	1	1	1	1	2	1	2	1	1	1	2
	4	2	2	3	1	2	2	1	1	1	2	1	1	3	2
	5	3	2	1	1	1	1	1	1	1	1	1	3	3	2

SYLLABUS **Periods (L+T)**

UNIT-I **(12+0)**

Concepts of Industrial Management: Principles of management- Growth of management thought, Functions of management, Principles of organization, Types of organization and committees.

Entrepreneurship / Emloyability

Introduction to personnel management- Functions, Motivation, Theories of motivation, Hawthrone studies, Discipline in industry, Promotion, Transfer, lay off and discharge, Labour turnover.

Entrepreneurship / Emloyability

UNIT-II **(9+3)**

Production Planning and Control

Types of productions, Production cycle, Product design and development - Process planning, Forecasting, Loading, Scheduling, Dispatching, Routing- Simple problems.
Materials Planning – ABC analysis – Incoming materials control – Kanban system – Just in time. MRP systems- Master Production Schedule – Bill of Materials –MRP II.)

Plant Layout

Plant location - Factors - Plant layout - Types - Layout design process – Computerized Layout Planning – Construction and Improvement algorithms -ALDEP - CORELAP and CRAFT.

UNIT-III **(9+3)**

Work study

Introduction to work study – Method study – Recording Techniques – charts & Diagrams Time study – stopwatch time study – Standard data - Method Time Measurement (M-T-M) – simple problems – Ergonomics.

Entrepreneurship / Emloyability

Entrepreneurship / Emloyability

UNIT-IV **(12+0)**

Materials Handling and Management- Principles, Concept of unit load, Containerization, Pelletization, Selection of material handling equipment, Applications of belt conveyors, Cranes, Forklift trucks in industry. Purchasing, Objectives of purchasing department, Buying techniques, Purchase procedure, Stores and material control, Receipt and issue of materials, Store records

Industrial relations- Trade unions, Industrial disputes, Strikes, Lock-out, Picketing, Gherao, Settlement of industrial disputes, Collective bargaining, Industrial dispute act 1947 and factories act 1948.

Entrepreneurship / Employability

UNIT-V **(9+3)**

Statistical Quality Control - Control charts of variables and attributes (p-chart, x-bar & R-chart , U-chart, KU-chart, C-chart)(Use of formulae only). single and double sampling plans.

Text Books:

1. Dr. O. P .Khanna , *Industrial Engineering Management,* 4th edition, Dhanpat Rai publications.
2. Martand Teslang *Industrial Engineering and Production Management* 2nd Edition, S. Chand & Co.

Reference Books:

1. Koontz & Donnel, *Principles of Management*, 3rd edition, Mc-Graw Hill Publishers.
2. Everette Adam & Ronald Ebert, *Production and Operations Management*, Prentice Hall, 1992.

Web resources:

1) www.iems.ucf.edu/
2) www.iise.org/
3) www.iiie-india.com/

DESIGN OF MACHINE ELEMENTS - II	
MEC 323	**Credits :- 4**
Instruction : 4Periods & 1 Tut/week	Sessional marks :- 40
End Exam : 3hrs	End Exam marks :- 60

Pre requisites: - Engineering Mathematics, Engineering Mechanics, Mechanics of solids

Course Objective:

The main intent of this course is to enhance creativity in designing of components, analyzing induced stresses in a component based on the type of failure. This is achieved through appropriate material selection and design analysis of components like gears, brakes, clutches, crank shaft, connecting rod etc.

Course Outcomes:

By the end of the course, the student will be able to:	
1	Design the various types of gears based on static and dynamic Loads.
2	Design the various IC engine components like connecting rod, crankshaft etc subjected to combined loads and frictional clutches based on pressure and wear.
3	Design various types of brakes and chain drives used in automobiles
4	Design and analyze the life of bearings subjected to static and dynamic loads.
5	Design crane hooks, wire ropes and chain drives subjected to various types of loads.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	2	3	2	2	1	1	1	1	1	1	1	2	3
	2	3	2	3	2	2	1	1	1	1	1	1	1	2	3
	3	3	2	3	2	2	1	1	1	1	1	1	1	2	3
	4	3	2	3	2	2	1	1	1	1	1	1	1	2	3
	5	3	2	3	2	2	1	1	1	1	1	1	1	2	3

SYLLABUS **Periods (L+T)**

UNIT-I **(15+5)**

Gears

Classification of gears, terminology of gears, standard tooth systems. force analysis on spur, helical, bevel and worm gears, beam strength and wear strength of gears for static and dynamic loads, effective load based on beam and wear strength, gear tooth failures, thermal design considerations of worm gears.

Emloyability

Emloyability

UNIT-II **(12+6)**

IC Engine parts: Classification of I.C. engines, design of cylinder and head, piston, connecting rod and crank shaft.
Friction clutches: Types of clutches, friction materials, torque transmission capacity of single, multi, cone and centrifugal clutches, energy equation and thermal considerations in friction clutches.

Emloyability

UNIT-III **(8+4)**

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Brakes: Types of brakes, energy equations, band and block brakes, internal expanding brakes.
Crane hook & wire Rope: Design of crane hooks with trapezoidal cross-section, wire rope construction and classification, stresses in wire ropes, design for service of lifts and winches.

Emloyability

UNIT-IV **(10+5)**

Rolling contact bearings: Types of rolling contact bearings, selection of material, static and dynamic load carrying capacity, equivalent bearing load, load-life relationship, load factor, selection of bearings from manufacturers catalogue.
Sliding contact bearings: Basic modes of lubrication, temperature effect on viscosity, hydro static and hydro dynamic bearing design, bearing characteristic number, McKee equations, Reynolds's equation, Raimond and Boyd method.

Emloyability

UNIT-V **(12+3)**

Belt drives: - Types of belt drives, geometrical relations, analysis of belt tensions, condition for maximum power, design of flat and V belt drives.
Chain drives: Classification, nomenclature, polygonal effect, power transmission of chain drive, length of chain drive.

Emloyability

Emloyability

Text books:

1. V.B.Bhandari, *Design of Machine Elements* 4th edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2016.
2. *Design data book* , PSG College of technology, Coimbatore, 2011.

Reference Books:

1. R.K. Jain, *Machine Design*, 9th edition, Khanna Publications.
2. Joseph Edward Shigley, *Mechanical Engineering design*, 8th Edition, McGraw Hill Company, 2011.
3. R.L.Norton, *Machine design, an integrated approach*, 2nd edition, Pearson Education, 2014.

Note: Design data book is allowed in examinations.

Web Resources:

1) http://www.nptelvideos.in/2012/12/design-of-machine-elements.html
2) https://www.machinedesignonline.com/
3) http://nptel.iitg.ernet.in/
4) https://vtechworks.lib.vt.edu/handle/10919/34877

ENGINEERING THERMODYNAMICS - III	
MEC 324	**Credits : 4**
Instruction : 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Engineering Mathematics, Engineering Mechanics, Basic Thermodynamics

Course Objective:

To impart knowledge on the basics of IC engines, gas turbines and compressors-their construction, working features and performance and further generate interest on combustion phenomena in IC engines.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Distinguish between different classes of IC engines, understand their working principles and further get acquainted with testing and performance of IC engines.
2.	Differentiate between air standard, fuel-air and actual cycles, their significance and also analyze the effect of various thermodynamic and engine parameters on the engine performance.
3.	Get a thorough knowledge on the concepts of combustion phenomenon and the effect of various engine parameters on it.
4.	Distinguish between various classes of compressors, understand their construction, working principles and also evaluate their performance including their characteristics.
5.	Understand the working principles of gas turbine plant and analyze the methods involved in improving its performance and also distinguish the features of various jet engines and rocket engines and their applications.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	2	2	2	1	1	1	1	1	1	1	1	2	2
	2	3	3	2	2	1	2	2	1	1	1	1	1	3	3
	3	1	1	2	2	1	2	2	1	1	1	1	1	1	1
	4	3	2	2	2	1	1	1	1	2	1	1	1	3	2
	5	2	2	2	2	1	1	1	1	2	1	1	2	2	2

SYLLABUS **Periods (L+T)**

Employability

UNIT-I **(16+4)**

I.C. engines:

Heat engines, engine components & nomenclature, working principle of engines- four stroke & two stroke engines, S.I & C.I engines, classification, carburetion-simple carburetor, Fuel injection systems-classification, fuel injection pump, Testing & performance-frictional power-Willan’s line method, Morse test, retardation test, indicated power, brake power-rope brake and hydraulic dynamometer, indicated & brake mean effective pressures, engine efficiencies, engine performance characteristics, heat balance sheet.

Employability

UNIT-II **(11+4)**

Cycles and analysis:

Air standard cycles- Otto, Diesel & Dual cycles-Thermal efficiency, work output and mean effective pressure, comparison of cycles-fuel-air cycles and their significance-composition of cylinder gases-variable specific heats-dissociation, comparison of air standard and fuel-air cycles, actual cycles and their analysis, time loss factor, heat loss factor, exhaust blow down, losses due to gas exchange process.

Employability

UNIT-III **(12+0)**

Combustion in IC engines:

Combustion in SI Engines: S.I. engines- Normal combustion and abnormal combustion-Importance of flame speed and effect of engine variables-types of abnormal combustion-pre-ignition and knock, knock limited parameters, effect of engine variables on knock, Combustion chamber requirements and Types of combustion chambers.

Combustion in CI Engines: Stages of combustion- Delay period and its importance- effect of engine variables, diesel knock-suction, compression and combustion induced turbulence, Direct & Indirect injection combustion chambers.

Fuel requirements, fuel rating and anti-knock additives.

Employability

UNIT- IV **(12+6)**

Air compressors:

Reciprocating Compressors: Classifications, indicated diagram, equation for work, isothermal efficiency-effect of clearance in compressors, free air delivered, volumetric efficiency, actual p-v diagram, single stage and multi stage compressors, effect of inter cooling in multi stage compressors.

Employability

Rotary Compressors: classification, steady flow compressors, static and stagnation quantities, centrifugal compressor-construction, working principle, velocity diagrams, Euler's work, Isentropic efficiency, slip factor & pressure co-efficient, compressor characteristics, Axial flow compressors–velocity diagrams – degree of reaction, polytropic efficiency, Surging & chocking.

Employability

UNIT- V **(6+4)**

Gas Turbines: Simple gas turbine plant-closed and open cycle gas turbines, Brayton cycle, Efficiency, work ratio and optimum pressure ratio for simple gas turbine cycle, actual cycle, methods for performance improvement- regeneration, Inter-cooling and reheating.

Jet propulsion: Turbo-jet engines, thrust, thrust power, efficiencies, Turbo-prop engines, Ram's jet and pulse jet engines, Rocket engines.

Employability

Text Books:

1. V. Ganesan, *Internal Combustion Engines* 4th edition, Tata McGraw Hill Education (P) Ltd, 2012.
2. R. K. Rajput, *Thermal Engineering* 10th edition, Laxmi publication (P) Ltd, 2017.

Reference books:

1. R. Yadav, *Applied Thermodynamics* 6th edition, Central Publishing House, Allahabad, 2011.
2. M.L. Mathur and R.P. Sharma, *Internal Combustion Engines* Danpat Rai Publications, 2016.
3. V. Ganesan, *Gas Turbines* 3rd edition, Tata McGraw Hill Education (P) Ltd, 2010.

Web resources:

1. http://www.uotechnology.edu.iq/dep-MechanicsandEquipment/Lectures%20and%20Syllabus/Lectures/Same/Third%20Grade/Internal%20Combustion%20Engines1.pdf

2. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Ref%20and%20Air%20Cond/pdf/R&AC%20Lecture%2020.pdf

OPERATIONS RESEARCH	
MEC 325	**Credits:3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Mathematics

Course Objective:

The course is intended to identify and develop operational research models, understand the mathematical tools to solve optimisation problems, and develop a report that describes the model, the solving techniques and analyse the results

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Apply linear programming model and assignment model to domain specific situations
2.	Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results
3.	Apply the concepts of PERT and CPM for decision making and optimally managing projects
4.	Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions
5.	Analyze the inventory and queuing theories and apply them in domain specific situations.

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	1	1	1	1	1	1	1	1	1	1	1	2	2
	2	1	3	2	1	1	1	1	1	1	1	1	1	3	2
	3	1	2	1	1	1	1	1	1	1	1	3	1	3	2
	4	1	1	1	1	1	1	1	1	1	1	3	1	3	2
	5	1	1	1	1	1	1	1	1	1	1	3	1	3	2

SYLLABUS **Periods**

(L+T)

UNIT I **(8+4)**

Employability

LINEAR MODEL

Introduction to Operations Research – Linear Programming - Mathematical Formulation – Graphical method – Simplex method – Two – Phase Simplex method ,Big-M method-Duality Simplex method.

Employability

UNIT II **(8+4)**

TRANSPORTATION AND ASSIGNMENT MODELS:

Transportation model – Initial solution by North West corner method – least cost method – VAM. Optimality test – MODI method and stepping stone method, Assignment model – formulation – balanced and unbalanced assignment problems.

UNIT III **(8+4)**

Employability

PROJECT MANAGEMENT BY PERT & CPM:

Basic terminologies – Constructing a project network – Scheduling computations – PERT - CPM – Resource smoothening, Resource leveling, PERT cost

Employability

UNIT IV **(8+4)**

REPLACEMENT AND SEQUENCING MODELS:

Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies), Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs on m machines, Traveling salesman problem.

Employability

UNIT V **(8+4)**

INVENTORY AND QUEUING THEORY

Employability

Variables in inventory problems, EOQ, deterministic inventory models, order quantity with price break, techniques in inventory management, Queuing system and its structure – Kendall‟s notation – Common queuing models - M/M/1: FCFS/∞/∞ - M/M/1: FCFS/n/∞ - M/M/C: FCFS/∞/∞ - M/M/1: FCFS/n/m

Text Books

1. S.D.Shrama, *Operation Research*, Kedar Nath Ram Nath Publishers, 2015.
2. Handy A. Taha, Operations Research An introduction, 10th edition, 2017.

Reference Books

1. Hira D S and Gupta P K, *Operations Research*, S.Chand & Sons, 2007.
2. Panneerselvan. R., *Operation Research*, Prentice Hall of India Pvt Ltd. 2006.

3. Kanti Swarup, Gupta P.K., and Manmohan, *Operations Research,* S.Chand & sons, 2004.

Web Resources

1) https://orc.mit.edu/
2) www.orsi.in/
3) https://www.journals.elsevier.com/european-journal-of-operational-research/
4) www.theorsociety.com/

PROFESSIONAL ELECTIVE-I STREAM-1 POWER PLANT ENGINEERING	
MEC 326	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites: Engineering Thermodynamics

Course objectives:

- The course is intended to provide overall view of all types of power plants, their working principles and further create a clear cut understanding of the economies of power plants and fixation of tariff rates.

Course outcomes:

By the end of the course, the student will be able to :	
1	Explain the working principle of steam power plant and its accessories
2	Understand the accessory systems working in tandem with internal combustion engine power plant and different configurations of gas turbine power plant
3	Comprehend different components of hydroelectric power plant and evaluate rainfall and run-off estimation
4	Describe the working principle and construction features of nuclear power plant and further classify reactors.
5	Analyze power plant economics and evaluate power tariff.

Mapping of course outcomes with program outcomes :

		PO												**PSO**	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO	1	1	1	2	1	1	2	3	2	2	2	2	1	2	2
	2	1	2	2	1	1	2	2	1	2	1	1	1	2	2
	3	1	1	2	1	1	2	2	2	2	1	2	1	2	2
	4	1	1	2	1	1	3	3	2	2	2	1	1	1	2
	5	1	1	1	1	1	2	2	2	2	2	3	1	2	2

SYLLABUS **Periods (L+T)**

Employability

UNIT-I **(10+2)**

Steam Power Plants

General layout, fuel handling, burning of coal - stoker firing -classification and principle, pulverised fuel firing -advantages and types of systems, draught systems- definition and types, boilers - fire tube boilers - Cochran boiler, Lancashire boiler, water tube boilers- Babcock and Wilcox boiler, Stirling boiler , high pressure and forced circulation boilers - Lamont boiler, Benson boiler, Velox boiler, mountings and accessories, boiler performance.

UNIT-II Employability **(12+0)**

Diesel engine Power Plants

Introduction, general layout of plant, applications, different systems of diesel power plant, supercharging.

Gas Turbine Power Plants

Introduction, classification - open cycle and closed cycle gas turbine power plants , components - compressor, Inter-coolers , heat exchangers, combustion chamber, gas turbines, different arrangements of gas turbine power plant, gas turbine fuels, simple Brayton cycle, combined gas turbine and steam power plants -basics.

Employability

UNIT-III **(10+2)**

Hydro Electric Power Plants

Introduction, hydrology, hydrologic cycle, rainfall, runoff and their measurement, hydrograph, flow duration curve, mass curve, classification of hydroelectric power plants, plant layout and its operation, elements of hydroelectric power plant - dam, surge tanks, spillways, draft tubes, conduits, power house, water hammer effect.

Employability

UNIT–IV **(12+0)**

Nuclear Power Plants

introduction, isotopes, nuclear fission, reproduction factor, moderation, fertile and fissile materials, nuclear reactors, components, classification - PWR, BWR, CANDU, gas cooled reactor, liquid cooled reactor, properties of fuels, moderator, coolant, control rods, reflector, cladding material, types of nuclear wastes and radioactive waste disposal systems.

Employability

UNIT-V **(8+4)**

Power Plant Economics

load curves, load duration curves, different terms and definitions- connected load, max demand, demand factor, average load, load factor, diversity factor, plant capacity factor, plant use factor - simple problems, cost analysis, selection of type of generation, economics in plant selection, base load plants, peak load plants, tariff methods for electrical energy- simple problems.

Employability

Text Books:

1. S.C.Arora & S. Domkundawar *A Course in Power Plant Engineering*, Dhanpat Rai & co (P) Ltd ,New Delhi

2. R.K.Rajput, *A Textbook of Power Plant Engineering* , 5th edition, Laxmi publications (P) Ltd New Delhi 2007.

Reference books:

1. Dr P.C.Sharma *A textbook of power plant engineering*, S.K.Kataria & Sons, New Delhi 2016.
2. P.K.Nag *Power Plant Engineering* 4th edition, Tata McGraw Hill publishers, 2014.
3. A.K.Raja, Amit Prakash Srivastava , Manish Dwivedi *Power Plant Engineering* , 1st edition New Age International limited, 2006.

Web Resources

1. http://www.power-eng.com/index.html
2. http://www.powermag.com
3. http://nptel.ac.in/courses/108105058/9
4. http://www.bechtel.com/expertise/power

PROFESSIONAL ELECTIVE-I STREAM-2 AUTOMATION IN MANUFACTURING	
MEC 326	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Manufacturing Technology–1, Manufacturing Technology–2 and Machine Drawing.

Course Objective:

To make the students understand the principles of advanced manufacturing procedures by providing the knowledge of various automation strategies used in production systems.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Understand the basic principles of automation and its components which are implemented in production systems.
2.	Identify the importance of material handling and various automatic identification methods used in production systems.
3.	Understand the components of manufacturing systems and different production lines implemented in production systems.
4.	Understand cellular manufacturing, forming part families, group technology and their involvement in flexible manufacturing systems.
5.	Understand various automated inspection methodologies and manufacturing support systems like CAPP, shop floor control, etc.

Mapping of Course Outcomes with Program Outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	1	1	1	1	1	1	3	1	1	2	1	1	1	1
	2	1	1	1	1	1	1	2	1	2	2	1	1	1	1
	3	1	1	1	1	1	1	1	1	2	1	2	1	1	1
	4	1	1	1	1	1	1	1	1	1	2	1	1	1	1
	5	1	2	1	2	2	1	1	1	1	2	1	1	2	1

SYLLABUS **Periods (L+T)**

UNIT-I **(12+0)**

Overview of Manufacturing and Automation:
Production systems, automation in production systems, automation principles and strategies, manufacturing operations, production facilities, basic elements of an automated system, levels of automation, hardware components for automation and process control, programmable logic controllers and personal computers.

Employability

UNIT-II **(12+0)**

Material Handling and Identification Technologies:
Material handling, equipment, analysis, storage systems, performance and location strategies, automated storage systems, AS/RS, types, automatic identification methods, Barcode technology, RFID.

Employability

UNIT-III **(10+2)**
Manufacturing Systems and Automated Production Lines:
Manufacturing systems- components of a manufacturing system, single station manufacturing cells; manual assembly lines, line balancing algorithms, mixed model assembly lines, alternative assembly systems, automated production lines, applications, analysis of transfer lines.

Employability

UNIT-IV **(10+2)**
Automated Assembly Systems:
Fundamentals, analysis of assembly systems, cellular manufacturing, part families, coding and production flow analysis, group technology and flexible manufacturing systems, quantitative Analysis.

Employability

Employability

UNIT-V **(12+0)**
Quality Control and Support Systems:
Quality in design and manufacturing, inspection principles and strategies, automated inspection, contact vs non-contact, CMM, manufacturing support systems, quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

Employability

Employability

Text Books:

1. Mikell. P. Groover, *Automation, production systems and computer integrated manufacturing* 3rd edition, Published by Prentice Hall, 2012.
2. P. Radha Krishnan & S. Subrahamanyarn and Raju, *CAD/CAM/CIM*, 3rd Edition New Age International Publishers-2003.

Reference Books:

1. Singh, Nanua, *System Approach to Computer Integrated Design and Manufacturing*, Published by Wiley.
2. Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang, *Computer Aided Manufacturing*, Pearson Publications - 2009.
3. R Thomas Wright and Michael Berkeihiser Good Heart, *Manufacturing and Automation Technology*, Willcox Publishers

Web resources:

1. nptel.ac.in/courses/112102011/
2. http://nptel.ac.in/courses/112103174/
3. http://www.appliedmfg.com/case-studies

PROFESIONAL ELECTIVE-I STREAM-3 ADVANCED MECHANICS OF SOLIDS	
MEC 326	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites: Mechanics of Solids & Engineering Mechanics

Course Objective:

The course is intended to educate students on the fundamentals of theory of elasticity, apply graphical methods to tri-axial state of stresses, familiarize with energy methods to determine deflections in beams and analyze stresses in rotating discs,continuous and fixed beams.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Familiarize with the fundamentals of theory of elasticity and apply Mohr's circle method to tri-axial state of stresses.
2.	Apply energy methods to evaluate deflections in beams and analyze the forces in a frame by the method of sections.
3.	Analyze the circumferential and radial stresses in rotating rings, solid and hollow discs.
4.	Acquaint with the concepts of contact stresses and determine the same for point, line and surface contact.
5.	Develop an understanding of methods of analysis used in dealing with statically indeterminate beams under various loading conditions

Mapping of course outcomes with program outcomes:

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3	2	2	1	1	1	1	1	1	1	1	3	2
	2	3	3	2	2	1	1	1	1	1	1	1	1	3	2
	3	3	3	2	2	1	1	1	1	1	1	1	1	3	2
	4	3	3	2	2	1	1	1	1	1	1	1	1	3	2
	5	3	3	2	2	1	1	1	1	1	1	1	1	3	2

SYLLABUS **Periods (L+T)**

UNIT-I **(9+5)**

Tri-axial stresses

Principal stresses & strains, directions of principal planes. principal planes and graphical solution using Mohr's circle and principal strains.

Theories of elasticity

Three dimensional stress and strain analysis, stress-strain transformation, stress invariants; equilibrium and compatibility equations, boundary conditions, two dimensional problems in cartesian co-ordinates.

Employability

Emloyability

UNIT-II **(7+3)**

Energy Methods

Strain energy and strain energy density, strain energy due to axial load, shear, flexure and torsion – Castiglione's theorems – Maxwell's reciprocal theorems.

Emloyability

Analysis of Perfect Frames

Introduction, types of frames, assumptions made in finding out the forces in a frame, reactions of supports of a frame, analysis of a frame, method of sections.

Emloyability

UNIT-III **(7+3)**

Rotating Rings & Discs

Introduction, stresses in a rotating ring, stresses in a rotating thin disc- circumferential and radial stresses in a solid disc, disc of uniform strength, circumferential and radial stresses in a hollow disc with a pin hole at the center.

Emloyability

UNIT-IV **(8+4)**

Contact stresses

Contact between a sphere and a half-space, contact between two spheres, contact between two cylinders with parallel axes, bearing contact, Hertzian theory of non-adhesive elastic contact- assumptions in Hertzian theory.

Emloyability

UNIT-V **(9+5)**

Fixed Beams

Introduction, bending moment diagram for fixed beams - slope and deflection for a fixed beam carrying- point load at center, an eccentric point load, a uniformly distributed load over the entire length, and fixed end moments of fixed beam due to sinking of a support.

Emloyability

Continuous beams

Introduction, bending moment diagram for continuous beams-Clapeyron's equation of three moments, Clapeyron's equation of three moments applied to beams with simply supported ends carrying point loads and uniformly distributed load – continuous beams with end supports fixed carrying point loads and uniformly distributed load

Emloyability

Text Books:

1. S.S.Ramamrutham& R, Narayanan, *Strength of Materials*, Dhanpat Rai Publishing Company (P) Limited, 2008
2. Dr Sadhu Singh, *Strength of Materials*, Khanna Publishers Pvt. Ltd, 2013
3. Timoshenko S.P. and James Gere, Mechanics *of Materials*, 5th edition, Van Nostrand Reinhold Co., 2001.

Reference Books:

1. R.K.Rajput, *Strength of materials*, 6th edition S.Chand Ltd. publications, 2015.
2. R.K.Bansal, *A Text Book of Strength of Materials*, 4th edition, Lakshmi Publications Pvt. Ltd. 2017.

Web References:

1) http://nptel.ac.in/courses/Webcourse-contents/IITROORKEE/
strength%20of%20materials/homepage.htm
2) http://www.aboutcivil.org/solid-mechanics.html
3) http://web.mit.edu/emech/dontindex-build/

DEPARTMENTAL ELECTIVE-I STREAM-4 PRODUCTION PLANNING AND CONTROL	
MEC 326	**Credits:3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Pre-requisite: Manufacturing Technology.
Course Objective:
To make the students acquaint with the planning and control of production operations.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Learn the basics of production planning and control by understanding its functions, types of production and forecasting techniques.
2.	Apply and evaluate inventory control models.
3.	Prepare the plans for smooth and efficient running of production operations.
4.	Use production scheduling techniques.
5.	Explain dispatching and follow-up of production operations.

Mapping of course outcomes with program outcomes:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	3	3	2	1	1	1	3	1	1	1	3	1	2	3
	2	3	3	2	1	1	1	3	1	1	1	3	1	2	3
	3	3	3	2	1	1	1	3	1	1	1	3	1	2	3
	4	3	3	2	1	1	1	3	1	1	1	3	1	2	3
	5	3	3	2	1	1	1	3	1	1	1	3	1	2	3

SYLLABUS **Periods (L+T)**

UNIT-I **(12+0)**

Introduction: Definitions — objectives of production planning and control- functions of production planning and control-elements of production control- types of production-organization of production planning and control.

UNIT-II **(12+4)**

Forecasting: Importance of forecasting — types of forecasting, their uses- general principles of forecasting techniques- Qualitative methods and quantitative methods- least square method, moving average method and exponential smoothing method.

Emloyability

UNIT-III **(10+2)**

Inventory management: Functions of inventory- Relevant inventory cost- ABC analysis- VED Analysis- Inventory control systems , P- Systems and Q — Systems, Introduction to MRP and ERP, LOB(Line of balance), JIT inventory, Japanese concepts.

Emloyability

UNIT–IV **(10+2)**

Routing: Definition, routing procedure- route sheets, bill of materials, factors affecting routing procedure.

Scheduling: Definition, difference with loading, scheduling polices, techniques, standard scheduling methods, job shop, flow shop, line balancing, aggregate planning, methods for aggregate planning, chase planning, expediting, control aspects.

Emloyability

UNIT-V **(10+0)**

Dispatching: Activities of dispatcher, dispatching procedure, follow up, definition, reasons for existence of functions, types of follow up, applications of computer in production planning and control

Text Books:

1. M.Mahajan *Production Planning and Control*, Dhanpati rai & Co.
2. R.Panneer Selvam *Production and operations Management*, 3rd edition, PHI. 2015.

Reference Books:

1. SK Mukhopadhyaya *Production Planning and Control- Text & cases*, 3rd edition, PHI. 2015.
2. S. D. Sharma *Operations Research* 13th Edition, Kedar Nath Ram Nath & Co.

Web Resources:

1. http://www.nptel.ac.in/courses/112102107

PROFESSIONAL ELECTIVE-I STREAM-5 **RAPID PROTOTYPING**	
MEC 326	**Credits:3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Manufacturing Technology

Course Objective:

This course provides an opportunity to the students to conceive, design, and implement products quickly and effectively, using the different rapid prototyping techniques.

Course Outcomes :

By the end of the course, the student will be able to:	
1.	Get acquainted with the various types of rapid prototyping techniques and the materials used.
2.	Distinguish between SLA and SGC and further apply these techniques in rapid prototyping.
3.	Differentiate between the various solid based rapid prototyping methods like LOM, FDM and their application.
4.	Discern the various powder based rapid prototyping methods like SLS and 3D Printing.
5.	Analyze the tools, data formats and optimizing techniques required for rapid prototyping.

Mapping of course outcomes with program outcomes :

		PO												PSO	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	2	1	1	2	1	1	1	1	3	2	2	2	1
	2	2	2	1	2	3	1	1	1	2	3	2	2	2	2
	3	2	2	1	2	3	1	1	1	2	3	2	2	2	2
	4	2	2	1	2	3	1	1	1	2	3	2	2	2	2
	5	3	3	2	2	1	1	1	1	2	3	2	2	3	2

SYLLABUS **Periods (L+T)**

UNIT-I **(12+0)**

Introduction to Rapid Prototyping

Fundamentals of Prototyping , History of Rapid Prototyping (RP) systems, Fundamentals of RP, Growth of RP industry, classification of RP systems.

Materials for RP: Introduction, Types of materials, liquid based materials, solid based materials, and powder based materials.

Employability

UNIT-II **(10+2)**

Liquid Based Rapid Prototyping

Stereo Lithography Systems: Principle of working, Process parameters, Data preparation, data files and machine details, applications.

Solid Ground Curing: Principle of operation, machine details, process, mask generation, model making applications.

Employability

UNIT-III **(10+2)**

Solid Based Rapid Prototyping

Laminated Object Manufacturing (LOM): Principle of operation, LOM materials. Process details, LOM machines application.

Fusion Deposition Modeling (FDM): Principle, process parameters, path generation, advantages, disadvantages and applications.

UNIT–IV **(10+2)**

Powder Based Rapid Prototyping

Selective Laser Sintering (SLS): Principle of operation, process parameters, Data preparation for SLS and applications.

Three dimensional Printing (3DP): Models and specifications, Process, working principle , Applications. Advantages and Disadvantages.

Employability

UNIT-V **(10+2)**

Rapid Tooling, Data Formats & Process Optimization

Employability

Rapid Tooling: Direct and Indirect methods for RT

Rapid Prototyping Data Formats: STL format, STL file problems, Building valid and invalid tessellated models, STL file repair, other translators, new formats, standards for representing layered manufacturing

Rapid Manufacturing Process Optimization: Factors influencing accuracy, data preparation errors, Part building errors, Error in finishing, influence of build orientation.

Text Books:

1. C. K. Chua, K. F. Leong, C. S. Lim *Rapid Prototyping: Principles and Applications*, 2nd edition, World Scientific publishing, 2003.
2. Kenneth G. Cooper, *Rapid Prototyping Technology: Selection and Application*, 1st edition, CRC press, 2001.

Reference books:

1. Dinjoy S.S verlog, *Rapid manufacturing*, London 2001.
2. Gurumurthi. IISc Bangalore. *Rapid prototyping materials*

Web Resources:

https://www.coursera.org/learn/3d-printing-revolution/

METROLOGY AND MECHATRONICS LAB	
MEC 327	**Credits : 2**
Instruction : 3 Periods /Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Course Objective:

To acquaint the students with calibrating measuring instruments and also to measure different parameters like angle, flatness, gear tooth parameters and alignment on spindles. Further the objective is also introduce PLC and familiarize them with ladder programming for applications like traffic light, conveyors, pneumatic actuators etc.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Calibrate the given measuring instruments.
2.	Measure parameters like taper angle, flatness of surface and gear tooth parameters using precision instruments.
3.	Conduct concentricity and roundness tests on a spindle.
4.	Select suitable sensors and transducers while designing a system to meet specified requirements.
5.	Interface the programmable logic controller with input/output components for various practical applications.

Mapping of course outcomes with program outcomes:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**				**2**				**3**	**1**	**1**			1	1
	2	**1**	**1**		**2**				**2**	**1**	**1**			1	1
	3	**1**			**2**				**2**	**1**	**1**			1	1
	4	**1**	**1**	**1**					**1**	**1**	**1**	**2**	**1**	1	1
	5	**3**	**3**	**3**		**3**	**1**			**2**		**3**	**2**	1	1

SYLLABUS

METROLOGY EXPERIMENTS

1. Calibration of the following instruments: (using slip gauges)
   i) Calibration of Micrometer. ii) Calibration of Vernier Caliper.
   iii) Calibration of Dial Gauge.
2. Measurement of (i) taper angle using Sine-Bar (ii) included angle using Bevel Protractor.
3. Alignment test: Circularity & Concentricity of the spindle.
4. Gear parameters Measurement:
   i) Diametrical pitch/module ii) Pitch circle diameter iii) Pressure angle iv) Tooth thickness.
5. Check the flatness of a surface plate using Auto-collimator.
6. Using light wave interference to study flatness of slip gauges
7. Determination of Angle of a V-block
8. Determination of Central distance of two holes of a specimen.

Employability

MECHATRONICS EXPERIMENTS

1. Study of PLC characteristics.
2. Training on Programmable Logic Controller - Sensor Training Kit
   a) Proximity Switch
   b) Photo Electric Switch
   c) Limit Switch
   d) Fiber optic sensor
3. Training on PLC for Traffic Signal Control using Ladder Logic Programme
4. Training on PLC for Lift Control using Ladder Logic Programme.
5. Training on PLC for Material Handling (Conveyor) using Ladder Logic Programme.
6. Training on PLC for Pneumatic control of single and double acting cylinders.

Employability

***Any 10 experiments consisting of at least 4 from each list of experiments stated above.**

Reference Books:

R.K. Jain, *Engineering Metrology*, Khanna Publishers.
Rajput, *A Textbook of Mechatronics*, 3rd edition, S. CHAND.

MECHANICAL ENGINEERING LAB-II	
MEC 328	**Credits : 2**
Instruction : 3 Periods /Week	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Course Objectives:

The laboratory serves the purpose of imparting training on the basics of internal combustion engines, their construction, operation and performance assessment. Further it also familiarizes the student to various mechanisms and applying kinematic principles to them.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Perform various tests on engines which would give a thorough idea on the methodology followed in evaluating the performance of I.C.engines.
2.	Make a comparison between graphical and analytical methods adopted in the analysis of some simple mechanisms.
3.	Understand gyroscopic principle and its applications and evaluate gyroscopic couple.
4.	Understand the principles of vapour compression refrigeration system and evaluate its performance.
5.	Conduct experiments on vibrations and determine various parameters like natural frequency / Moment of Inertia of the body etc.

Mapping of course outcomes with program outcomes:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	2	1	3	2	1	2	1	2	2	1	1	2	1
	2	3	1	3	1	1	1	1	1	1	1	1	1	2	1
	3	3	1	1	2	1	1	1	1	1	1	1	1	2	1
	4	3	2	1	2	1	1	3	1	1	1	1	1	2	1
	5	3	2	2	2	1	1	1	1	1	1	1	1	2	1

SYLLABUS:

<u>Group-1(Thermal Engineering)</u>

1. Load test on I.C. Engines.

2. Morse test on multi-cylinder engine.

3. Heat balance sheet on I.C. Engines.

Skill Development

4. Retardation test on slow speed Diesel engine

5. To draw the crank angle vs. pressure diagram for a VCR engine.

6. Determination of efficiencies of a given 2-stage air compressor.

7. Assembling and dis-assembling of 2-stroke and 4-stroke engines.

8. To find out the theoretical, actual and relative COP of a vapour compression refrigeration system.

9. Measurement of dryness fraction of steam using separating and throttling calorimeter.

Group-2 (Theory of machines)

10. To draw the curves of

a) Slider displacement and linear velocity w.r.t. time (crank angle) for a slider crank mechanism and compare with theoretical values.

b) Angular displacement and angular velocity w.r.t. time of the output link of a four bar mechanism.

11. To determine the gyroscopic couple and compare with the theoretical values.

12. Determination of ratios of angular speeds of shafts connected by Hooke's joint.

13. To determine the radius of gyration of given bar by using Bi-Filar suspension.

14. To verify the Dunkerley's Formula.

Skill Development

Note: Any 10 experiments to be conducted taking at least three from each group

Reference Books:

1. R. K. Rajput, *Thermal Engineering* 10th edition, Laxmi publication (P) Ltd.
2. S. S. Rattan, *Theory of Machines*, 4th edition, McGraw-Hill Publications, New Delhi (2011)

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	
MEC 412	**Credits:3**
Instruction : 3periods & 1Tut/Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Prerequisites: -NIL

Course objectives: To make the students to learn the fundamentals of managerial economics and explain the concepts of costs and break – even analysis. To acquaint the students with the different market situations and forms of business organization. To impart the knowledge of financial accounting.

Course outcomes:

By the end of the course, the student will be able to:	
CO-1	Apply the basics of managerial economics such as micro versus macro economics and demand analysis.
CO-2	Describe different types of costs and apply the various costs associated with production to determine break – even point.
CO-3	Analyze different markets and forms of business organization by means of their features, merits and demerits.
CO-4	Explain how to manage capital.
CO-5	Prepare final accounts of a sole proprietor.

Mapping of course outcomes with program outcomes:

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**	2	1		2		2	1	3	3		3	1
	2	1	1	2	1		2	1	3	3		3	2
	3	1	1		1		2	1	3	3		3	1
	4	1	1	2	1		2	1	3	3		3	2
	5	1	1	2	1		2	1	3	3		3	2

SYLLABUS

Periods (L+T)

UNIT-I **(9+3)**

Introduction to Managerial Economics: Definition; micro and macro economics; demand analysis - demand determinants, law of demand and its exceptions, elasticity of demand; demand forecasting - survey methods, statistical methods.

Enterprenuership Skills

UNIT-II **(9+3)**

Cost Analysis: Cost concepts - opportunity cost, fixed vs. variable costs, explicit vs. implicit costs, out of pocket vs. imputed costs; Break Even Analysis -determination of break-even point (simple problems).

Enterprenuership Skills

Enterprenuership Skills

UNIT-III **(12+0)**

Market Structures: Types of competition; features of perfect competition; imperfect competition monopoly, monopolistic competition.

Types of Business Organization and Business Cycles: Sole trader; partnership; joint stock company; pubic enterprises; business cycles - definition and characteristics, phases of business cycle.

UNIT-IV **(11+1)**

Capital –Types and Sources: Fixed and working capital; methods and sources of finance.

UNIT-V **(9+3)**

Introduction to Financial Accounting: Final accounts of a sole proprietor - preparation of trading account, profit and loss account, balance sheet.

Enterprenuership Skills

Text Books:

1. Managerial Economics and Financial Analysis by A. R. Aryasri; McGraw-Hill Education (India) Private Limited, New Delhi (2015).
2. Engineering Economics, Volume I by Tara Chand; Published By Nem Chand & Bros, Roorke (2007).

Reference Books:

1. Managerial Economics by Varshney & Maheswari; Published by Sultan Chand, 2007.
2. Financial Accounting by Shim &Siegel; Published by Schaum's Outlines, TMH 2007.

Web Resources:

http://www.nptel.ac.in
http://www.freevideolectures.com

HEAT TRANSFER	
MEC 413	**Credits : 4**
Instruction : 4 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Mathematics-I, Fluid Mechanics, Engineering Thermodynamics-1

Course Objective:

- To acquaint the students with the principles involved in the modes of heat transfer and few of its applications in engineering equipment.

Course Outcomes:

By the end of this course, student will be able to:	
1.	Apply the principles of conduction heat transfer to evaluate the temperature distribution and heat transfer rate in steady one-dimensional heat transfer problems.
2.	Evaluate the efficiency and effectiveness of fins and further comprehend the different classes of unsteady heat transfer problems and solve them.
3.	Evaluate the heat transfer rate in both internal and external flow conditions under free or forced convection.
4.	Calculate the heat transfer coefficient in boiling and consednation process and evaluate the performance of heat exchangers.
5.	Apply the laws of radiation to solve practical heat transfer problems where radiation is significant.

Mapping of course outcomes with program outcomes:

Strong -3, Medium -2, Low -1

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	2	2	3	3		2		1	2		2	
CO-2	2	2	3	3		2		1	2		2	
CO-3	2	2	3	3		2		1	2		2	
CO-4	2	2	3	3		2		1	2		2	
CO-5	2	2	3	3		2		1	2		2	

SYLLABUS

Periods (L + T)

UNIT-I Conduction Heat Transfer (12 + 8)

Basic Concepts:
Mechanism of heat transfer, basic laws of heat transfer, thermal conductivity, concept of driving potential, thermal resistance and electrical analogy; Generalised heat conduction equations in Cartesian, Cylindrical & Spherical coordinate systems.

One-Dimensional Steady conduction:
Systems without internal heat generation – Steady state heat conduction through plate, composite-slabs, cylinders & spheres; Variable thermal conductivity; Critical radius of insulation.

Employability

UNIT-II Extended Surfaces & Unsteady Heat Conduction (8 + 4)

Extended Surfaces:
Heat conduction through fins of uniform cross section only – Fin efficiency & effectiveness.

Transient heat conduction (One-Dimensional):
Lumped system analysis, systems with negligible surface resistance, semi-infinite bodies, Heisler's chart and Groover chart solutions.

Employability

UNIT-III Convective Heat Transfer (12 + 6)

Fundamentals:
Mechanisms of convection, Nusselt number, Velocity boundary layer – Surface shear stress, thermal boundary layer, Prandtl number, Laminar & turbulent flows – Reynolds number, Differential convection equations in 2D – review of continuity, momentum equations (without derivations), energy equations derivation, Blausius similarity solution for flat plate, Analogies – Reynolds, Colburn analogies, Significance of non-dimensional numbers.

Employability

Forced & Free Convection:
External flow – correlations for heat transfer coefficient and friction coefficients – laminar and turbulent flow over flat plate.
Internal flow – Hydrodynamic & Thermal entry lengths – developing & fully developed flows, Use of empirical relations for flow through tubes.
Mechanism of natural convection, development of hydrodynamic & thermal boundary layer along vertical plate, use of correlations for heat transfer – for vertical, horizontal and inclined plates.

Employability

UNIT-IV Heat Transfer with Phase Change & Heat Exchangers (8 + 5)

Boiling & Condensation:
Boiling: Pool boiling regimes – Pool boiling correlation, flow boiling inside tube.
Condensation: Laminar film wise condensation, Nusselt's theory condensation on vertical flat plate, horizontal tubes, drop-wise condensation.

Employability

Heat Exchangers:
Classification of Heat Exchanger, Overall heat transfer coefficient, fouling in heat exchanger, Analysis of heat exchanger – LMTD method and NTU method (parallel & Counter flow only).

UNIT-V Radiation Heat Transfer (8 + 4)

Employability

Fundamentals:
Introduction, Electromagnetic wave spectrum, Thermal radiation; Black body radiation – Stefan Boltzman's law, Plank's law, Wein's Displacement law; Radiation intensity – Lambert's cosine law; Radiation properties – Emmisivity, absorptivity, reflectivity, transmissivity, Kirchoff's law;

Radiation heat exchange between surfaces:
Shape factor, shape factor algebra; Radiation in non-absorbing media – Radiosity; Radiation heat transfer between gray bodies, electrical analogy, radiation heat transfer in two surface enclosure, radiation shields.

Employability

Text Books:

1. Dr. Sachdeva, *Fundamentals of Engineering Heat and Mass Transfer*, edition 4, New Age International Publishers Limited, 2010.
2. A.F. Mills & V. Ganeshan, *Heat Transfer*, edition 2, Pearson Publishers, 2009.

Reference Books:

1. Er. R.K. Rajput, *Heat and Mass Transfer*, edition 4, S. Chand Limited, 2007.
2. Heat and Mass Transfer: Fundamentals and Applications, Yunus A Cengel; Afshin J. Ghajar, 5th Editiion, Tata Mc Graw Hill.

Data Book:

1. Heat and Mass Transfer Data Book , C.P.Kothandaraman , S. Subramaniam, 8th Edition, New Age International Publishers Limited.

COMPUTER AIDED DESIGN	
MEC 414	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

C-Programming Lab, Engineering Drawing, Machine Drawing, Strength of Materials, DMM-I and DMM-II.

Course Objective:

To introduce students the fundamentals of CAD, Geometric modeling, capabilities of CAD packages, CAD approach for design problems & Artificial intelligence.

Course Outcomes:

By the end of the course, the student will be able to:	
CO1	Explain the usage of computer peripherals and Graphic display devices.
CO2	Develop wireframe model, surface model and solid model.
CO3	Analyse the behaviour of mechanical components using FEM packages.
CO4	Design the algorithms and implement them in solving mechanical design problems.
CO5	Apply the technique of Artificial Intelligence to design problems.

Mapping of course outcomes with program outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO-1	1									1		
CO-2	2	2	3	2	3					1	1	1
CO-3	2	3	3	2	3					1	1	1
CO-4	2	3	2	2	3				2	1	1	1
CO-5	2	1	2	2	2	1			2	1	1	

SYLLABUS

Periods

(L +T)

UNIT-I **(7+1)**

Emloyability

Fundamentals of CAD:

Introduction - The design process - Application of computers for design - Operating systems - Hardware in CAD: The design work station - I/O Devices - CAD system configuration - Creating database for manufacturing - Benefits of CAD.

Interactive Computer Graphics - Graphic display devices- Graphics system- Graphics standards - Graphical user interface.

Emloyability

UNIT-II **(16 +2)**

Geometric Modeling:

Emloyability

Modeling Techniques - Wire frame Modeling - Surface Modeling - Solid Modeling; half space method, B-rep, CSG, sweep representation, analytical solid modeling, primitive instancing, and spatial partitioning. 2D and 3D transformations, windowing and clipping.

Emloyability

UNIT-III **(11 + 1)**

Capabilities of CAD packages:

Introduction to Finite Element Analysis - CAD techniques to finite element data preparation- Automatic mesh generation- presentation of results – 3 dimensional shape description and mesh generation- CAD applications of FEM. Introduction to CAD packages like ANSYS, NASTRON, NISA.

Emloyability

UNIT-IV **(12 + 4)**

CAD approach for design problems:

Computer aided design approach for coil springs, spur gear, disk clutches, internal expanding shoe brake and kinematics of slider crank mechanism. CAD approach for cross sectional area and centroid of L, T and I sections.

UNIT-V (5 + 1)

Artificial Intelligence:

Introduction - Expert system and its structure, Building an expert system. Applications of AI in design and CAD.

Emloyability

Text Books:

1. CAD/CAM- Computer Aided Design & Manufacturing, by M.D.Groover & E.W.Zimmer, 1stEdition, PEARSON Publication, 2003.
2. Computer Aided Design and Manufacturing, by Dr.Sadhu Singh, Khanna Publishers, 5th Edition, Khanna Publisher, 2015.

References:

1. Computer Aided Design in Mechanical Engineering, by V.Rama Murthy, 3rd Edition, McGraw-Hill, 1998.
2. Elements of Computer Aided Design & Manufacturing, by Y.C.Pao, 1st edition, Wiley publications, 1984.
4. Computer Aided Design and Manufacturing, by C.B.Besant & C.W.K.Lui, 3rd edition , Ellis Horwood Ltd, 1985.
5. Computer-Aided Analysis & Design by S. Ghosal, Prentice Hall of India, Prentice Hall India Learning Private Limited,1997.
6. CAD/CAM/CIM by Radhakrishna, New Age International Pvt. Ltd. Publishers, 2009.

Web Resources:

1. http://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/Computer%20Aided%20Design%20&%20ManufacturingI/index.htm
2. http://www.mrrtechnical.co.in/#cad

GAS TURBINES AND JET PROPULSION	
MEC415 (A)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites: Engineering Thermodynamics – I, III & Fluid Mechanics

Course Objective:

To provide an insight on the principles of compressible fluid flow, gas turbine power cycles and furtherto create an understanding of the working principles of axial flow compressors, axial flow gas turbines,combustion chambers and jet propulsion systems.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Analyze compressible fluid flow and its characteristics
2.	Explain the working principles of gas turbine power cycles and evaluate their performance characteristics.
3.	Comprehend the working characteristics of Axial flow compressors, evaluate the effect of blade design on the performance and further analyze operational disturbances.
4.	Explain the combustion phenomena in a gas turbine & the working principles of Axial flow gas turbines.
5.	Distinguish the different types of jet propulsion systems and their relative merits and demerits and their applications.

Mapping of course outcomes with program outcomes:

	PO											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO 1	2									1		
CO 2	2	1								1		1
CO 3	2	2	2	1	1				2	1		1
CO 4	2	2	2	1		2	2		1	1		1
CO5	1	2								1		

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SYLLABUS

Periods

(L + T)

Employability

UNIT-I **(8 + 2)**

Introduction to compressible flow

Introduction- Conservation of Mass - Continuity Equation- Conservation of Energy (First Law of Thermodynamics)- Momentum Equation- Sonic Velocity, Mach Number and Mach Waves- Stagnation Temperature, Pressure and Enthalpy- Isentropic Flow Through a Passage of varying cross sectional Area- choking and isentropic flow, operation of nozzle under varying pressure ratio- converging, converging-diverging nozzle.

Employability

UNIT-II **(8 + 2)**

Employabilit

Gas Turbine Power Cycles

Introduction- Brayton Cycle- Brayton Cycle with Regeneration- Complex Cycle- Closed Cycle, Performance of actual gas turbine cycle: Efficiency of the compressor and Turbine- Pressure or Flow Losses- Heat Exchanger Effectiveness- Effect of varying mass Flow-Loss due to incomplete combustion- Mechanical Losses- Effect of Variable Specific Heats - Calculation of Fuel consumption and cycle Efficiency- Polytropic Efficiency- Performance of Actual Cycles.

Employability

UNIT-III **(12+ 3)**

Employability

Axial Flow Compressors

Introduction- Description- Principle of Operation- Performance Analysis- Momentum, Stage Velocity Diagrams, Symmetric Stage, Non-Symmetric Axial -in flow, Non-Symmetric Axial-outflow- Actual Energy Transfer- Airofoil Analysis, One Dimensional Ideal Incompressible Flow, Two Dimensional flow With Friction- Blading Efficiency, Losses in terms of Air Angles and Drag Co efficient- Coefficient of Performance, Flow Coefficient (Φ), Pressure Coefficient (ψ_p),Work Coefficient(Ω)- Blade Loading- Cascade Characteristics-Blade angles- Reynolds and Mach Number Effects- Three Dimensional flow Analysis, Radial Equilibrium Theory, Free Vortex Blades, Constant Reaction Blades, Forced Vortex of Solid Rotation Blades, The General Design -Three Dimensional Blades, Losses- Compressor Stall, Surge and choke- Overall Performance- Compressor Characteristics.

Employability

UNIT-IV Employability **(13+ 2)**

Combustion Systems

Introduction- Combustion theory applied to gas turbine combustion, factors affecting combustion chamber design and performance – Pressure loss, Combustion intensity and Efficiency;

Requirements of the Combustion chamber- Process of Combustion- Combustion geometry, mixing and dilution, Combustion chamber arrangements.

Employability

Axial Flow Gas Turbines

Introduction- Description- Turbine and Nozzle efficiencies- Degree of Reaction, Ideal Impulse Turbine, Impulse Turbine with Loss, Blades Speed Ratio, Velocity Ratio and Torque, Velocity Compound Turbine (Curtis Stage)- The Reaction Turbine- Three Dimensional Flow Analysis, The Free Vortex Blades

Employability

UNIT-V **(8+ 2)**

Jet Propulsions

Introduction-The Ramjet Engine-The Pulse-jet Engine- The Turbo-jet Engine-Thrust Equation-Specific Thrust of the Turbo Jet Engine- Efficiencies- Inlet Diffuser or Ram Efficiency- thermal Efficiency of the TurboJet Engine- Propulsive Efficiency - Overall Efficiency of a Propulsive system-parameters affecting flight performance, Effect of Forward Speed- Effect of Altitude - Overall Turbojet Process- Thrust augmentation- The After burn, Injection of Water-Alcohol Mixtures- Bleed, Burn Cycles.

Employability

Text Books:

1. V. Ganesan, *Gas Turbines*, 3rd edition, McGraw Hill Education, 2017.
2. P.R. Khajuria and S.P. Dubey, *Gas Turbines and Propulsive Systems,* Dhanpat Rai Publiations, 2012.

Reference Books:

1. Dr. R. Yadav ,*Steam and Gas turbine and Power plant Engineering*,7th edition, Central Publishing House, 2000.
2. H.I.H. Sarvanamuttoo,G.F.C. Rogers & H. Cohen, *Gas Turbines Theory*, 7th edition, Pearson Publications, 2017

Web Resources:

1. http://www.nptel.ac.in/courses/112106166/

PRODUCT DESIGN AND MANUFACTURING	
MEC 415 (B)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Manufacturing Technology-1, Material Science, Design of Machine Elements-I

Course Objective:

- To acquaint the students with the design process and models as applied to various manufacturing processes and materials and further introduce them to Value Engineering and environmental factors in the design process

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Explain the generalized design process and analyze various key design models
2.	Analyze the type of failure and determine geometric dimensions and stresses on mechanical components subjected to various types of stresses
3.	Apply various strategies in the product design process
4.	Apply design processes for manufacturing techniques like injection molding and machining.
5.	Analyze economics and human ergonomic factors in design and explain basics of value engineering and environmental factors in the design process

Mapping of course outcomes with program outcomes:

	PO											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO 1	1	3	2	1				2	2	1		
CO 2	1	3	2	1				1		1		
CO 3	1	3	2	1				1	1	1		
CO 4	1	3	2	1				1		1		
CO5	1	3	2	1		3	2	1	2	1	2	1

SYLLABUS

Periods

(L +T)

UNIT-I (11+1)

Design philosophy:

Employability

Introduction to product design and manufacturing,Product design definition, and evolution.,Product design morphology, Product design morphology: Preliminary ,and detailed design.Design process, Problem formation, Introduction to product design, Various design models-Shigley model, Asimov model and Norton model, Need analysis, Strength considerations -standardization. Creativity, Creative techniques, Material selections and its criteria, Notches and stress concentration, design for safety and Reliability

Employability

UNIT-II (13 +1)

Failure theories:

Employability

Fracture mechanics theory, Fatigue mechanisms, Fatigue failure models, Design for fatigue strength and life, creep; Types of stress variation, design for fluctuating stresses, design for limited cycles, multiple stress cycles, Fatigue failure theories ,cumulative fatigue damage, thermal fatigue and shock, harmful and beneficial residual stresses, Yielding and transformation

Employability

Employability

UNIT-III (9+ 1)

Product Design:

Product flowcharting, Creativity techniques, Translating customer needs, Product Development process ,Product strategies, Product value, Product planning, Product specifications, Product Concept generation, Concept selection, Concept testing.

Employability

UNIT-IV (10 + 2)

Design for Machining and Injection Molding:

Machining Using Single-Point & Multi point cutting tools, Choice of Work Material, Shape of Work Material, Machining Basic Component Shapes, Cost Estimating for Machined

Employability

Components, Injection Molding Materials, The Molding Cycle, Injection Molding Systems, Molding Machine Size, Molding Cycle Time.

UNIT-V **(12+ 2)**

Employability

Economic And Environmental factors in design:

Economic analysis, Human engineering considerations, Ergonomics, Design of controls, Design of displays. Value Engineering: a product design approach, Elements of Value Engineering, Value Engineering tools, Case study in Value Engineering, Material and process selection in value engineering, Modern approaches in design, Techniques to reduce Environmental Impact

Text Books:

1. A.K. Chitale and R.C. Gupta, *" Product Design and Manufacturing"*, Prentice Hall.
2. Joseph Shigley and Mischke, *" Mechanical Engineering Design",* 6th th edition, Tata McGraw Hill.

Reference Books:

1. R.L. Norton, *" Machine Design* - *An Integrated Approach"* , Prentice Hall.
2. Karl T. Ulrich and Steven D. Eppinger, *" Product design and development"*. 3rd edition,Tata Mc GrawHill.

Web Resources:

1. https://www.vidyarthiplus.com/vp/attachment.php?aid=42037
2. http://www.howdoesacarwork.com/p/1-engines_10.html
3. http://www.nptelvideos.in/2012/12/design-of-machine-elements.html

ROBOTICS	
MEC 415 (C)	**Credits:3**
Instruction : 3periods & 1Tut/Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Course objective:

To familiarize the students with the automation and brief history of robot development, impart knowledge on kinematics of robots, robot end effectors and their design, various sensors and their applications in robots and further acquaint them with robot programming methods, languages of robot & machine vision and artificial intelligence of robots.

Course outcomes:

By the end of the course, the student will be able to:	
CO-1	Elucidate the fundamental principles of Robot Technology, Programming, and Applications
CO-2	Explain the Control Systems and Components of a robot and further analyze robot Motion and its Control.
CO-3	Write programmes in various methods to control a robot for simple applications.
CO-4	Explain the nuances of machine vision and artificial intelligence as applied to the field of robotics.
CO-5	Describe the applications of robots in Material Transfer, Machine Loading/Unloading, Assembly, Inspection and various other Processing operations

Mapping of course outcomes with program outcomes:

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**	2	1				1			1	1	1	1
	2	2	2	1	1		1			1	1	1	1
	3	1	1	1	1	2	1			1	1	1	1
	4	1	1	1		1	1			1	1	1	1
	5			1			2			1	1	1	1

SYLLABUS

(L+T)

UNIT 1 Fundamentals of Robotics **(6+4)**

Introduction

Automation and Robotics, A Brief History of Robotics, The Robotics Market and the Future Prospects.

Fundamentals of Robot Technology, Programming, and Applications

Robot Anatomy, Work Volume, Robot Drive Systems, Control Systems, Precision of Movement, End Effectors, Robotic Sensors, Robot Programming and Work Cell Control, Problems.

Emloyability

UNIT 2 The Robot and its Peripherals (12+4)

Emloyability

Control Systems and Components

Basic Control Systems Concepts and Models, Controllers, Control System Analysis, Robot Transducers and Sensors, Tactile Sensors, Proximity and Range Sensors, Velocity Sensors, Miscellaneous Sensors, Robot Actuators, Robot End Effectors -Types of End Effectors, Mechanical Grippers, Other Types of Grippers, Tools as End Effectors, Considerations in Gripper Selection and Design, Power Transmissions Systems, Modeling and Control of a Single Joint Robot, Problems.

Robot Motion Analysis and Control

Introduction to Manipulator Kinematics, Homogeneous Transformations and Robot Kinematics, Manipulator Path Control, Robot Dynamics, Configuration or a Robot Controller, Problems

Employability

Emloyability

UNIT 3 Robot Programming and Languages (12+4)

Robot Programming

Methods of Robot Programming, Lead through Programming Methods, A Robot Program as a Path in Space, Motion Interpolation, Wait, Signal, and Delay Commands, Branching Capabilities and Limitations of Lead through Methods.

Emloyability

Robot Languages

The Textual Robot Languages, Generations of Robot Programming Languages, Robot Language Structure, Constants, Variables, and Other Data Objects, Motion Commands, End Effector and Sensor Commands, Computations and Operations, Program Control and Subroutines, Communications and Data Processing, Monitor Mode Command

Emloyability

UNIT 4 Machine Vision and Artificial Intelligence of Robots (8+2)

Machine Vision

Introduction to Machine Vision, The Sensing and Digitizing Function in Machine Vision, Image Processing and Analysis, Training the Vision System, Robotic Applications.

Emloyability

Artificial Intelligence

Introduction, Goals of AI Research, AI Techniques, LISP Programming, AI and Robotics, LISP in the Factory, Robotic Paradigms

Emloyability

UNIT 5 Robot Applications in Manufacturing (7+1)

Material Transfer, Machine Loading/Unloading and Processing operations

General Considerations in Robot Material Handling, Material Transfer Applications, Machine Loading and Unloading, Processing Operations- Spot Welding, Continuous Arc Welding, Spray Coating, Other Processing Operations using Robots

Emloyability

Assembly and Inspection

Assembly and Robotic Assembly Automation, Parts Presentation Methods, Assembly Operations, Compliance and the Remote Center Compliance (RCC) Device, Assembly

Emloyability

System Configurations, Adaptable-Programmable Assembly System, Designing for Robotic Assembly, Inspection Automation

Emloyability

Text Books:

1. Mikell P. Groover, Mitchell Weiss ,Roger N. Nagel Nicholas G. Odrey, Industrial Robotics-Technology, Programming, and Applications, 2nd edition, McGraw-Hill Higher Education ©1986
2. Lung-Wen Tsai, Robot Analysis- The Mechanics of Serial and Parallel Manipulators, JohnWiley & Sons,1999

Reference Books:

1. King-Sun Fu, R.C. Gonzalez and C.S.George Lee, Robotics Control Sensing Vision And Intelligence, 1st edition, Mc Graw-Hill Education International Ed (1987)
2. John J. Craig, Introduction to Robotics - Mechanics and Control, 3rd edition, Addison-Wesley Longman Inc., 1999.

Web Resources:

https://www.youtube.com/watch?v=0yD3uBshJB0

TOTAL QUALITY MANAGEMENT	
MEC 415 (D)	**Credits:3**
Instruction : 3periods & 1Tut/Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Prerequisite: Industrial Engineering and Management.

Course Objectives: To acquaint the students basic concepts of quality and quantity from organizational point of view and the concept of western and Japanese approaches and processes, the internal politics, quality culture, education and training of the organization. The objective is also to familiarize the students about international/national Quality systems and various industrial oriented TQM methods.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Explain the quality environment and TQM philosophies.
2.	Describe TQM processes and Brain storming methods.
3.	Elucidate QPD & QFD for customer satisfaction.
4.	Explain international/national Quality systems.
5.	Analyze various industrial oriented TQM methods.

Mapping of Course Outcomes with Programme Outcomes.

High-3, Medium-2, Low-1

	PO1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
CO-1		1	2	1	1	1	1	1	1	1	2	1
CO-2	2	1		2	3	3	2	2	2	1	3	1
CO-3	1	1	2	1	2	2	1	2	3	3	3	2
CO-4	1	1	1	1	1	2	3	3	1	1	3	1
CO-5	2	2	1	1	1	1	2	1	2	3	2	1

Syllabus

Periods

(L +T)

UNIT-I

Concepts of TQM: **(10+2)**

Philosophy of TQM, Customer focus, Organization, Top management commitment, Team work, Quality philosophies of Deming, Crossby and Muller.

Enterprenuership Skills

UNIT-II

TQM process: **(10+2)**

QC tools, Problem solving methodologies, New management tools, Work habits, Quality circles, Bench marking, Strategic quality planning.

Enterprenuership Skills

UNIT-III

TQM systems: **(10+2)**

Quality policy deployment, Quality function deployment, Standardization, Designing for quality, Manufacturing for quality.

UNIT-IV

Quality system: **(10+2)**

Need for ISO 9000 system, Advantages, Clauses of ISO 9000, Implementation of ISO 9000, Quality costs, Quality auditing, Case studies.

UNIT-V

Implementation of TQM: **(6+6)**

Steps, KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods, Case studies.

Enterprenuership Skills

Text Books:

1. Total Quality Management by Rose, J.E., Kogan Page Ltd., 1993.
2. The Essence of Total Quality Management by John Bank, PHI, 1993.

Reference Books:

1. Beyond Total Quality Management by Greg Bounds, Lyle Yorks et al, McGraw Hill, 1994.
2. The Asian Productivity Organization by Takashi Osada, 1991.
3. KAIZEN by Masaki Imami, McGraw Hill, 1986.

Web Resources:
http://www.nptel.ac.in
http://www.freevideolectures.com

FINITE ELEMENT ANALYSIS	
MEC 415 (E)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Mathematics, Mechanics, Strength of materials.

Course Objective:

To introduce students to the basics of FEM, other solution methods and derive the finite element equations for one dimensional and two dimensional elements. The objective is also to make students to apply FEM to structural and heat transfer problems.

Course Outcomes:

By the end of the course, the student will be able to:	
CO1	Apply various analytical methods to solve simple engineering problems, compare and contrast FEM with other analytical methods and explain the steps involved in FEM.
CO2	Solve one dimensional structural problems using FEM.
CO3	Apply FEM to Solve Plane Truss and Beam problems.
CO4	Solve two dimensional structural problems using CST and Axisymmetric elements.
CO5	Apply FEM to solve one dimensional steady state problems in Heat transfer.

Mapping of course outcomes with program outcomes:

	PO											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO 1	3	3		1	2				2	2		1
CO 2	3	3		1	2				2	2		1
CO 3	3	3		1	2				2	2		1
CO 4	3	3		1	2				2	2		1
CO5	3	3		1	2				2	2		1

SYLLABUS

Periods

(L +T)

UNIT-I:

FUNDAMENTAL CONCEPTS: (12+2)

Introduction, Historical Background, Stresses and Equilibrium, Boundary conditions, Strain-Displacement relations, Stress-strain relations, Compatibility conditions, Temperature effects, Plane stress and Plane strain conditions, Initial and Boundary value problems, Classification of boundary value problems, Types of boundary conditions.

Employability

Methods for solution of a general field problem-Potential energy method- Rayleigh-Ritz method-Galerkin method, Advantages of FEM over other methods, Steps involved in FEM, Engineering applications of FEM.

Employability

UNIT-II:

Employability

ONE-DIMENSIONAL PROBLEMS: (10+2)

Introduction, Finite Element Modelling, Coordinates and Shape Functions, Derivation of Element stiffness matrix and load vectors using Potential-Energy approach and Galerkin approach, Assembly of the Global Stiffness Matrix and Load Vector, Properties of Stiffness matrix, The Finite Element Equations;Treatment of Boundary conditions, Temperature effects- Problems.

Employability

UNIT-III

ANALYSIS OF TRUSSES: (10+2)

Trusses-Introduction-Derivation of element stiffness matrix-problems in Plane Trusses.

ANALYSIS OF BEAMS:

Employability

Beams-Introduction-Finite Element Formulation, Load vector, Boundary conditions, Shear force and bending moment.

Employability

UNIT-IV:

TWO-DIMENSIONAL PROBLEMS USING CST: (10 + 2)

Introduction-Finite Element Modelling-Constant-Strain Triangle (CST), Problem modelling and Boundary Conditions-Problems.

Employability

AXISYMMETRIC SOLIDS SUBJECTED TO AXISYMMETRIC LOADING:

Introduction-Axisymmetric Formulation-Finite Element Modelling: Trangular element, Problem Modelling and Boundary conditions-problems.

Employability

UNIT-V: (8 + 2)

SCALAR FIELD PROBLEMS:

Introduction-one dimensional steady state heat transfer in walls and fins, two dimensional steady state heat conduction, Convergence requirements.

Employability

TEXT BOOKS:

1. Tirupathi R. Chandrupatla, Ashok D.Belegundu *Introduction to Finite Elements in Engineering*, Fourth edition, Pearson education, 2011.
2. S.S.Rao *The Finite element method in engineering*, 5th edition, Elsevier publications, 2010.

REFERENCE BOOKS:

1. JN Reddy *An introduction to the Finite element method*, McGraw Hill Education; 3rd edition, 2005.
2. C.S. Krishnamoorthy Finite Element Analysis: Theory and Programming, Tata McGraw-Hill Education, 1995.
3. S.S. Bhavikatti *Finite element analysis*, New Age International, 2005.

WEB RESOURCES:

https://onlinecourses.nptel.ac.in/noc16_me02

http://www.open.edu/openlearn/science-maths-technology/introduction-finite-element-analysis/

REFRIGERATION AND AIR CONDITIONING	
MEC 416(A)	**Credits:3**
Instruction : 3periods & 1Tut/Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Prerequisites:

Engineering Thermodynamics

Course Objectives:

To acquaint the student with different types of refrigeration systems working , their application and also to evaluate their performance.

Course Outcomes:

The student will be able to:

CO-1	Differentiate the commercially available refrigeration systems and select appropriate refrigeration for a given application.
CO-2	Analyze the working principles of Vapour Compression Refrigeration Systems (VCRS) and the method of improving its performance
CO-3	Explain the functioning of components used in VCRS system and selection criteria of refrigerants.
CO-4	Comprehend different types of Vapour Absorption Refrigeration Systems (VARS)
CO-5	Apply the basics of Psychrometry processes, in calculating air conditioning loads for various applications.

Mapping of Course Outcomes with Programme Outcomes.

High-3, Medium-2, Low-1

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**		**1**		**2**	**3**	**3**		**1**	**1**	**1**
CO2	**3**	**2**	**1**	**2**		**2**	**2**			**1**	**1**	**2**
CO3	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**3**		**2**	**1**	**1**
CO4	**2**	**2**	**1**	**1**		**2**	**3**	**1**		**2**	**1**	**2**
CO5	**3**	**3**	**1**	**2**	**1**	**2**	**3**	**1**		**1**	**1**	**2**

SYLLABUS

Periods

(L +T)

Employability

UNIT-I **(10+2)**

Introduction and Gas cycle Refrigeration: Basic principles- Methods of Refrigeration- Joule Thomson coefficient-liquefaction of gases by linde's process -Unit of Refrigeration- Applications of Refrigeration.

Air cycle Refrigeration: Reversal Carnot cycle- Bell Coleman cycle- Air cycle systems for air craft refrigeration - Boot strap system- Regenerative cycle- Reduced ambient type- Comparisons of different systems.

Employability

UNIT-II **(10+2)**

Vapour Compression Refrigeration: Wet versus Dry compression- Effect of evaporator and condenser pressures. Liquid sub-cooling-superheating -Simple vapour compression Refrigeration cycle and its analysis. Actual VCRS- Methods of improving C.O.P.- Basics of multi pressure systems- Flash gas removal and Flash inter cooling- Defrosting- Hot gas defrosting.

UNIT-III Employability **(10+2)**

Classification of Refrigerants: Nomenclature- Properties- Secondary refrigerants- Selection of refrigerants

Employability

Evaporators- Once through, flooded, shell and tube Baudelot cooler- **Expansion devices-** Automatic expansion valve ,Capillary expansion device, Thermostatic expansion device.

UNIT-IV **(10+2)**

Absorption Refrigeration System: Simple vapour absorption system-max C.O.P. of absorption refrigeration system - Common refrigerant-absorbent systems-Aqua ammonia absorption system- Li-Br

Employability

absorption refrigeration system- Electrolux refrigeration- - Comparison of vapour compression and vapour absorption system.

Employability

Steam jet refrigeration system and analysis- Ejector compression system.

UNIT-V **(10+2)**

Air conditioning: Fundamentals of psychrometry-Basic processes in conditioning of air- Sensible heat factor- By pass factor- Air washer-Water injection, Steam injection. Summer and Winter air conditioning systems- Different types of Air conditioning load -RSHF, GSHF- Fresh air quantity- Cooling coils and Dehumidity-Choice of inside design conditions-cold storage-industrial air conditioning-comfort air conditioning and effective temperature-comfort chart, salient features Human comfort

Employability

Text Books:

1. Refrigeration and Air conditioning, by C.P.Arora. 3Rd Edition , Tata Mc Graw Hil publishers ,2012
2. Refrigeration and Air conditioning, by P.L.Bellany. 6th edition , Khanna publishers,1983.

References:

1. Refrigeration and Air conditioning, by Jordan R.C. and Priester G.B. 2nd edn. Prentice-Hall, 1965
2. Principles of Refrigeration, by Dossat. 5th edition ,Pearson Education publisher ,2002.

Web Resources:

http://nptel.ac.in/downloads/112105129

nptel.ac.in/courses/Webcourse.../Ref%20and%20Air%20Cond/New_index1.html

COMPUTERIZED NUMERICAL CONTROL MACHINES & COMPUTER AIDED MANUFACTURING	
MEC 416(B)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Manufacturing Technology – 1, Manufacturing Technology – 2, Manufacturing Technology - III

Course Objective:

This course makes the students understand the emergence and development of numerical control machine, characteristics and application areas. It familiarizes the components of computer aided manufacturing and computer aided process planning.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Explain about automated manufacturing system, elements and strategies of automation and its historical development and its future trends and further compare NC, CNC and DNC machines and explain their working.
2.	Describe the structural format of a manual part program and generate simple as well as complex part programs for CNC turning machine tools.
3.	Manually generate simple and complex manual part programs in CNC milling machine tools and also explain the hardware configuration of programmable logic controllers (PLC's).
4.	Describe the recent trends in CAM along with the concepts of Flexible manufacturing systems (FMS) and Computer integrated manufacturing (CIM).
5.	Explain the components of Group technology (GT) along with its applications in manufacturing processes and also describe the classifications of computer aided process planning (CAPP) techniques, computer aided quality control and its components and their importance as support systems in computer aided manufacturing (CAM).

Mapping of course outcomes with program outcomes:

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**		1	1	1						1		1
	2	2	1	3	2	2					1		1
	3	2	1	3	2	2					1		1
	4		1	1							1		1
	5			1	1					2	1		1

SYLLABUS **Periods (L+T)**

UNIT-I **(14+1)**

INTRODUCTION TO COMPUTER NUMERICAL CONTROL MACHINES

Introduction to Automation: Automated Manufacturing system; Need of automation, Basic Elements of automation, Levels of automation, Automation Strategies, Advantages & Disadvantages of automation, Historical development and future trends.
CAM - concept and definition: NC, CNC and DNC - concept, features and differences. Advantages and limitations of CNC, Selection criteria for CNC machines. CNC machines: Types, classification, working and constructional features. Elements of CNC machines - Types, working and importance of: Slide ways, Re-circulating ball screw, Feedback devices (transducers, encoders), Automatic tool changer (ATC), Automatic pallet changer (APC), CNC axes.

UNIT-II **(7+8)**

CNC TURNING MANUAL PART PROGRAMMING

Definition and importance of various positions like machine zero, home position, work piece zero and program zero, programming format and structure of part program.
ISO G and M codes for turning-meaning and applications of important codes.
Simple and Complex Manual part programming for turning using ISO format in straight turning, taper turning (linear interpolation) and convex/concave turning (circular interpolation), CNC Turning manual part programming using Canned cycles. Introduction to Automatic part programming.

UNIT-III **(7+8)**

CNC MILLING MANUAL PART PROGRAMMING

ISO G and M codes for milling-meaning and applications of important codes, Simple and Complex part programming for milling using ISO format - Importance, types, applications and format for: I. canned cycle's II. Macro III. Do loop IV. Subroutine
CNC turning and milling part programming using canned cycles, Do loops and Subroutine, Need and importance of various compensations: i. Tool length compensation. ii. Tool radius compensation. iii. Tool offset. Simple and Complex part programming using various compensations. Introduction to Automatic part programming.

UNIT-IV (14+1)

INTRODUCTION TO COMPUTER AIDED MANUFACTURING

Recent Trends in CAM :Interfacing standards for CAD/CAM - Types and applications, Adaptive control- definition, meaning, block diagram, sources of variability and applications. Flexible Manufacturing System (FMS) - concept, evaluation, main elements and their functions, layout and its importance, applications, Computer Integrated Manufacturing (CIM) - Concept, definition, areas covered, benefits.

Employability

Employability

UNIT-V

***COMPUTER AIDED MANUFACTURING SUPPORT SYSTEMS* (14+1)**

Introduction to GT, benefits, part families, part classification and coding, product flow analysis, cellular manufacturing, adaptation consideration in GT, quantitative analysis in cellular manufacturing, GT applications for manufacturing processes.

CAPP, benefits, types, forward and backward planning implementation considerations, process planning systems, CAQC (Computer aided quality control), JIT (Just in time) principles, MRP (Material requirements planning).

Employability

Employability

Text Books:

1. Pabla B.S., Adithan M.., "*CNC Machines*", New Age International, New Delhi, 2014 (reprint)
2. P.N. Rao, N. K. Tewari., "*Computer Aided Manufacturing*" Tata Mc Graw Hill Pub. New Delhi,2008.
3. Steve Krar and Arthar Gill, "*CNC Technology and Programming*", McGraw Hill Pub. Company, New Delhi, 1990.

Reference books:

1. Mikell P. Grover, "*Automation, Production Systems and Computer-Integrated Manufacturing*", Pearson Education, New Delhi.
2. P. Radha krishnan & S. Subramanyan, *"CAD/CAM/CIM"*, Willey Eastern Limited New Delhi,2008.
3. Groover, M. P., Zimmer, W.E., "CAD/CAM: Computer Aided Design and Manufacturing", Prentice Hall, 2011.

Web resources:

1. http://nptel.ac.in/courses/112105211/
2. **http://nptel.ac.in/courses/112102103/**

AUTOMOBILE ENGINEERING	
MEC 416 (C)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Theory of Machines-I, Material Science, Design of Machine Elements-II, Basic Electrical and Electronic Systems

Course Objective:

- To acquaint the students with the working of various automobile systems like engine, transmission, suspension, vehicle control, electrical and electronics.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Classify automobiles and explain the constructional features of engine parts.
2.	Explain the operational features of various systems of engines used in an automobile.
3.	Comprehend various transmission systems of an automobile.
4.	Distinguish various suspension systems and appreciate the vehicle control systems.
5.	Explain the principles related to electrical and electronic systems used in an automobile.

Mapping of course outcomes with program outcomes:

	PO											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO 1	1		1							1		1
CO 2	1	2	2	1	1		1			1		1
CO 3	1	1	2	1						1		1
CO 4	1	1	2	1						1		1
CO5	1	1		1	1				2	1	1	1

SYLLABUS

Periods (L +T)

UNIT-I **(9+1)**

Introduction:

Employability

Automobile - Definition, layout, classification; chassis, materials, Automobile body- parts, stream lining; construction details of engine components- cylinder block and crank case, cylinder, cylinder head, piston and piston rings, crank shaft, connecting rod, manifold and muffler.

UNIT-II **(13+1)**

Engine Systems:

Employability

Classification - based on arrangement of cylinders, Multi-Valve engines, VCR engines, Super Charging/Turbo charging; Air filters. Fuel Systems: Petrol Engines: Carburetted- Simple, S.U, Zenith, Solex, MPFI and SEFI, Ignition Systems- Conventional and Electronic. Diesel Engines: Conventional-Jerk type and distributor type; CRDI. Exhaust Emissions and their control: EGR and Catalytic Converters, EURO/Bharat Stage Norms: I, II, III, IV and V. Engine Cooling: Natural circulation and forced circulation. Lubrication: Mist, dry sump and wet sump.

Employability

UNIT-III **(15 + 1)**

Transmission System and Running System:

Clutch: Necessity, Construction and Working Principles of cone clutch, single & multi plate, centrifugal, CVT and Fluid coupling/Torque converter. Gearbox: Necessity of Transmission and Transaxle, Construction and Working Principle of Sliding mesh, Constant mesh- dog clutch, Synchromesh, Epicyclical and Automatic Gearbox. Drive Shaft: Constructional Features, Universal/Hooks Joints, Slip Joint, Types of Propeller shafts. Final drive and Differential: Necessity, Constructional Features and Working Principle of Open and LSD. Front/Rear Axles: Constructional Features and Types of Rear Axle Floating. Wheels: Disc and Drum type. Tires: Tire Construction, Tube and Tubeless Tires, Radial Tires, Tire specification, Tire rotation.

Employability

UNIT-IV **(11 + 1)**

Suspension System and Vehicle Control:

Employability

Suspension System: Types of suspension systems- MacPherson strut and Wishbone,Coil and Leaf Springs, Shock absorbers, Wheel alignment- Kingpin angle, Castor, Camber, Toe-in, and Toe-out. Vehicle Control: Steering system: Steering gear box and its types, Steering gear ratio, Constant Velocity Joints and linkages, Power Steering. Brake system: Necessity, Drum, Disc, Parking and Power Brakes, Parts and Working Principle of Mechanical, Air and Hydraulic Brakes, Anti-lock Braking System.

Employability

UNIT-V **(7 + 1)**

Electrical and Electronic Systems:

Electrical system: Basics of Electrical/Electronic Systems: Battery, Starting system, Charging System, Lighting and Signalling System, A/C Electrical System. Electronic System: Electronic Engine Management system, Automotive Embedded Systems-Vehicle Security System and

Employability

Working Principle of Computer Sensors: Temperature, Flow, Cam, knock, and Oxygen, coordination of sensors for engine processes.

Employability

Text Books:

1. Dr. Kirpal Singh, *Automobile Engineering Vol-I & II*, 12th edition, Standard Publishers, 2011.
2. William H. Crouse and Donald L. Anglin, *Automotive Mechanics*, 10th edition,Tata McGraw-HillPublishing Company Limited, 2006.
3. KK Jain & RB Asthana,*Automobile Engineering*, edition ,Tata McGraw-Hill Publishing Company Limited, 2002.

Reference Books:

1. S. Srinivasan, *Automotive Mechanics*, edition 2, Tata McGraw-Hill Publishingcompany Limited, 2003.
2. Joseph Heitner, *Automotive Mechanics (principles and practices*,2nd edition, East West press, 2006.
3. S Srinivasan,*Automotive Engines*, edition, Tata McGraw-Hill Publishing Company Limited, 2001.

Web Resources:

1. https://www.vidyarthiplus.com/vp/attachment.php?aid=42037

2. http://www.howdoesacarwork.com/p/1-engines_10.html

Entrepreneurship Development	
MEC 416(D)	**Credits:3**
Instruction : 3periods & 1Tut/Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Prerequisite: Managerial economics and financial analysis, Industrial engineering and management

Course Objective:
To develop and strengthen entrepreneurial qualities in students by imparting basic entrepreneurial skills to run a business effectively and efficiently.

Course Outcomes:

At the end of the course the student will be able to

CO-1	Exemplify the entrepreneurship concept and the qualities required for a successful entrepreneur.
CO-2	List the various supporting organizations for promoting entrepreneurship and the government policies.
CO-3	Prepare a feasibility report for a new business venture.
CO-4	Assess the requirements for small business ventures like finance and human resources.
CO-5	Comprehend the management techniques of small business and rehabilitation of business units.

Mapping of course outcomes with program outcomes :

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**	2	1	1	1	1		1		1		1	1
	2	3	3	3	2	1		1		1		1	1
	3	3	2	3	2	1		1		1		1	3
	4	2	3	2	1	1		1		1		1	1
	5	2	3	3	2	1		1		1		1	3

SYLLABUS (L+T)

UNIT I

ENTREPRENEURAL COMPETENCE: (10+2)

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality - Characteristics of Successful Entrepreneur – Knowledge and Skills of Entrepreneur.

UNIT II

ENTREPRENEURAL ENVIRONMENT: (10+2)

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services - Central and State Government Industrial Policies and Regulations - International Business.

Enterprenuership Skills

UNIT III

BUSINESS PLAN PREPARATION: (10+2)

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.

UNIT IV

LAUNCHING OF SMALL BUSINESS: (10+2)

Finance and Human Resource Mobilization -Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Venture capital, IT startups.

UNIT V

MANAGEMENT OF SMALL BUSINESS: (10+2)

Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business.

Enterprenuership Skills

Text Books:

1. NVR Naidu& T. Krishna Rao, *"Management and Entrepreneurship*", I.K International Publishing House Pvt. Ltd, 2009.
2. Vasant Desai, *"Dynamics of Entrepreneurial Development & Management",* Himalaya Publishing House.

References: .

1. Poornima M. Charantimath, *"Entrepreneurship Development",* Small Business Enterprises Pearson Education 2006
2. S. S. Khanka "*Entrepreneurship Development",* S. Chand & Co,2013.
3. Stephen Robbins *"Management",* Pearson Education/PHI 17th Edition, 2003.

Online Reference: http://nptel.ac.in/courses.php

NANO TECHNOLOGY	
MEC 416 (E)	**Credits:3**
Instruction : 3periods & 1Tut/Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Prerequisites: --- Engineering mathematics ,engineering physics,engineering chemistry and material science.

Course Objective

To acquaint the student on the basic scientific concepts of nanoscience, properties of nano materials, characterization of materials, synthesis , fabrication and also the applications of nano technology in various science, engineering and technology fields.

Course outcomes:

By the end of the course, the student will be able to:	
CO-1	Explain the essential basic concepts used in nanotechnology
CO-2	Analyze the nano materials with regards to their properties, synthesis and fabrication.
CO-3	Apply various characterization techniques used for evaluating the properties of nano materials.
CO-4	Analyze the characterization of carbon nano tubes.
CO-5	Comprehend the applications of nano technology to various fields

Mapping of course outcomes with program outcomes:

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**	1			1		1	1		1	1		1
	2	2	2	2	3		2	2		1		1	1
	3	2	1		2					1		1	1
	4	2	1	3	2		2	2		2	1	1	1
	5	1		2	1		3	2		2	1	2	1

SYLLABUS

Periods (L+T)

UNIT-I **(11+1)**

INTRODUCTION: History of nano science, definition of nanometer, nano materials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes, Band structure.

Employability

PROPERTIES OF MATERIALS:

Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

UNIT-II

SYNTHESIS AND FABRICATION: **(11+1)**

Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle - Bottom Up Approach - sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach - Ball milling, micro fabrication, lithography. Requirements for realizing semiconductor nano structures, growth techniques for nano structures.

Employability

UNIT-III

CHARACTERIZATION TECHNIQUES: **(11+1)**

X-Ray diffraction and Scherer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, Raman spectroscopy.

Employability

UNIT-IV

CARBON NANO TECHNOLOGY: **(11+1)**

Characterization of carbon allotropes, synthesis of diamond - nucleation of diamond, growth and morphology. Applications of nano crystalline diamond films, graphene, applications of carbon nano tubes.

Employability

UNIT-V

APPLICATIONS OF NANO TECHNOLOGY: **(14+1)**

Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin fins, applications of quantum dots.

TEXT BOOKS:

1. Nano science and nano technology by M.S Ramachandra Rao, Shubra Singh, Wiley publishers, Year: 2013.
2. Introduction to Nanoscience and Nanotechnology by K.K.A.N. Banerjee Chattopadhyay, A. N. Banerjee, Year: Feb 23, 2007.

3. Introduction To Nanoelectronics: Science, Nanotechnology, Engineering, And Applications Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio , Year : 2010.

REFERENCE BOOKS:

1. Introduction to Nano Technology by Charles P. Poole, Jr., Frank J.Owens, Wiley publishers, Apr 16, 2004.
2. Nanotechnology by Jermy J Ramsden, Elsevier publishers, Sep 19, 2012.
3. Nano Materials- A.K.Bandyopadhyay/ New Age International Publishers, Year : 2007.
4. Nano Essentials- T.Pradeep/TMH, Jan 20, 2007.
5. Nanotechnology the Science of Small by M.A Shah, K.A Shah, Wiley Publishers, Year : 2013.
6. Principles of Nanotechnology by Phani Kumar, Scitech, Year : 2010.

Web Resources:

http://www.nptel.ac.in
http://www.freevideolectures.com

HEAT TRANSFER LABORATORY	
MEC 417	**Credits : 2**
Instruction : 3 Periods	Sessional Marks : 50
End Exam : 3 Hours	End Exam Marks : 50

Pre-Requisite: Engineering Thermodynamics-I, Fluid Mechanics, Heat transfer

Course Objective:

To demonstrate the principles of conduction, convection and radiation.

Course Outcomes:

By the end of this course, student will be able to:	
1.	Determine thermal conductivities of different materials by utilizing different experimental setups.
2.	Evaluate the heat transfer coefficient in free and forced convection.
3.	Compute the time taken for heating and cooling of bodies in different environments using the principles of unsteady heat conduction and experimentally verify them.
4.	Evaluate the emissivity of a Gray body and Stefan Boltzmann constant.

Mapping of Course Outcomes with Programme Outcomes.

High-3, Medium-2, Low-1

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		3				1	2	1	1	
CO2	2	2		3				1	2	1	1	
CO3	2	2		3				1	2	1	1	
CO4	2	2		3				1	2	1	1	

List of Experiments:

1) Determination of thermal conductivity of asbestos powder at different heat inputs in hollow sphere.
2) Determination of thermal conductivity of glass wool at different heat inputs in composite cylinder.
3) Determination of thermal conductivity of metal rod (Brass).

4) Determination of overall heat transfer coefficient of composite wall.
5) Determination of convective heat transfer coefficient of vertical cylinder in free convection.
6) Determination of convective heat transfer coefficient of horizontal pipe in forced convection.
7) Determination of Stefan Boltzman constant.
8) Determination of Emissivity of Grey body.
9) Determination of fin effectiveness and efficiency under forced convection.
10) Determination of time interval in different mediums under unsteady state heat transfer.
11) Determination of condensation coefficient in film and drop wise condensation.
12) Determination of overall heat transfer coefficient of double pipe heat exchanger.

Employability

Data Book:

1. Heat and Mass Transfer Data Book , C.P.Kothandaraman , S. Subramaniam, 8^{th} Edition, New Age International Publishers Limited.

E-Resources : www.physicsclassroom.com , www.biocab.org/Heat_Transfer.html

COMPUTER AIDED DESIGN LAB	
MEC418	**Credits:2**
Instruction : 3periods /Week	Sessional Marks :50
End Exam : 3hrs	End Exam Marks: 50

Objectives

To train the students in using the drafting, modelling and analysis softwares in mechanical engineering applications like preparing 2D and 3D drawings, structural analysis, thermal analysis and modal analysis of components and further acquaint the students with CNC programming and ROBO programming.

Course outcomes:

By the end of the course, the student will be able to:	
CO-1	Draft 2-dimensional drawings of any mechanical component.
CO-2	Design and assemble 3D part models.
CO-3	Evaluate the stresses in beams and trusses in static conditions.
CO-4	Determine the heat loss from a fin and further perform modal analysis for beams using ANSYS software.
CO-5	Develop and execute programs for CNC Machine, further perform material handling using Pick and Place ROBOT.

Mapping of course outcomes with program outcomes:

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**	1			2	3					1		1
	2	1	2	3	2	3					1		1
	3	1	3	3	2	3					1		1
	4	1	3	3	2	3					1		1
	5	1	2	3	3	3					1		1

CAD experiments:

1. Drawing the orthographic views of cotter joint using AutoCAD
2. Drawing the orthographic views of knuckle joint using AutoCAD
3. Preparing Part model, Assembly and drawing of Oldham coupling
4. Preparing Part model, Assembly and drawing of Universal coupling
5. Preparing Part model, Assembly and drawing of Screw Jack
6. Static analysis of beam using ANSYS
7. Static analysis of Truss using ANSYS
8. To evaluate the temperature distribution and the heat loss from a fin subjected to temperature boundary conditions.
9. Evaluating the mode shapes and frequencies of a cantilever beam.

CAM experiments:

Employability

1. Preparation of manual part programming for CNC turning/Milling.
2. Machining of one job on CNC machine tool.
3. Robot programming through computer.

Employability

Skill Development & Employability

Industrial Training	
MEC 419	**Credits:2**
Instruction : -	Sessional Marks :100
End Exam : Viva-voce	End Exam Marks:-

The curriculum is designed to include industrial training so that the student is given an exposure to industry for a period extending from 2 – 3 weeks at the end of third year. The student should go through a training programme in any local industry / workshop. The training programme is decided by the industry people so that the student gets a practical understanding of the industrial processes. At the end of the programme the student should submit a comprehensive report to the department.

The evaluation of the industrial training for the award of grade is done in the final year 1st semester and is based on internal Viva – voce examination.

The project is divided into two phases. The phase-I is done in final year first semester followed by the phase-II which is executed in the second semester.

PROJECT (PHASE-1)	
MEC 420	**Credits:4**
Instruction : 5 Practicals	Sessional Marks :100
End Exam : Viva-voce	End Exam Marks: -

In the first phase, the student is exposed to the requirements to be met in the project. The student is given an opportunity to decide the area of work based on his interest. Once the area of work is decided, the student is required to do literature review and summarize the findings. Based on the review, the student and the guide are supposed to finalize the problem and chart out the procedure for executing the project work.

For an analytical work, the governing equations should be developed and the mathematical techniques to be used in solving them should also be completed.

For an experimental based project, the setting up of experimentation, materials & accessories procurement should be completed.

For an Analysis project which is based on software tools, modelling should have been completed.

For fabrication of a model, the basic design & development of the model and procurement of accessories should be completed.

The evaluation of Phase-I of the project work is based on an internal Viva-voce examination which is conducted twice. The first evaluation is done in the mid of the semester followed by the final evaluation at the end of the semester. The student has to submit a report.

INSTRUCTION & CONTROL SYSTEMS	
MEC 421	**Credits:3**
Instruction : 3 Periods & 1 Tutorial /Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Prerequisites:

Engineering Physics and Applied Physics

Course objective:

The course focuses on imparting the principles of measurement which includes the working mechanism of various transducers and devices that are in use to measure the important physical variables and also to introduce the basics of control systems and PLC.

Course outcomes:

By the end of the course, the student will be able to:	
CO-1	Explain the basic principles of measurements, calibration procedures and select an appropriate transducer for displacement measurement in any application.
CO-2	Elucidate the working principles of temperature and pressure measuring devices for various ranges and select a suitable device for experimentation.
CO-3	Explain the working principles of level, flow, speed and vibration measuring instruments and select a suitable one for any practical application.
CO-4	Describe the principle of working of force & torque measuring instruments and use them for experimentation. Further calculate the strain in a component using strain gauge rosettes.
CO-5	Explain the elements of control systems, PLC, their applications and develop ladder programs for logic gates.

Mapping of course outcomes with program outcomes:

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**	1	2		3		1			1	1	1	1
	2	1	2		3		1			1	1	1	1
	3	1	2		3		1			1	1	1	1
	4	2	2		3		1			1	1	1	1
	5	2	2		3	1	1			1	1	1	1

SYLLABUS **Periods**

(L+T)

UNIT-I **(8+2)**

Introduction: Basic principles of measurement – measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Static and Dynamic performance characteristics – sources of error, classification and elimination of error, calibration procedures.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – piezo-electric, inductive, capacitance, resistance, ionization and photo electric transducers.

skill development

UNIT-II **(10+2)**

Measurement of Temperature: Classification – ranges – various principles of measurement – expansion, electrical resistance – thermistor – thermocouple – pyrometers.

skill development

Measurement of Pressure: Units – classification – different principles used. Manometers, piston, bourdon pressure gauges, bellows – diaphragm gauges. Low pressure measurement – thermal conductivity gauges – ionization pressure gauges, McLeod pressure gauge.

skill development

skill development

UNIT-III **(10+2)**

Measurement of Level: Direct method – indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – bubbler level indicators.

Flow Measurement: Rotameter, magnetic, ultrasonic, turbine flow meter, hot – wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed: Mechanical tachometers – electrical tachometers – stroboscope

Measurement of Acceleration And Vibration: Different simple instruments – principles of seismic instruments – vibrometer and accelerometer using this principle.

skill development

skill development

UNIT-IV **(10+2)**

Measurement of Force, and Torque - Elastic force meters, load cells, torsion meters, dynamometers.

Stress - Strain Measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending, compressive and tensile strains – usage for measuring torque, strain gauge rosettes.

skill development

skill development

skill development

UNIT-V **(10+4)**

Elements of Control Systems: Introduction, importance – classification – open and closed systems, servomechanisms–examples with block diagrams–temperature, speed & position control systems.

Text Books:

1. A.K.Sawheny, "*Mechanical Measurements and Instrumentation",3rd edition,* Dhanpat Rai, 2004.
2. I.J. Nagrath & M.Gopal, "*Control Systems Engineering"*, New age international, 4th edition, 2006.

Reference Books:

1. D.S.Kumar, *"Measurement Systems: Applications & design",* 6th edition, Metropolitan, 2002.
2. J.P.Holman, *"Experimental Methods for Engineers"*, 7th edition McGraw-Hill, 2010.
3. A.K.Tayal & Akash Tayal, *"Instrumentation, Mechanical Measurements and Control"*, 2nd Edition, Galgotia Publications Pvt Ltd, 1999.

Web resources:

https://www.youtube.com/watch?v=DHjpkPoUk4I
https://www.youtube.com/watch?v=g1kb-hn_if4
https://www.youtube.com/watch?v=y9B0NqNF11I

NON-CONVENTIONAL ENERGY SOURCES	
MEC 422 (A)	**Credits:3**
Instruction : 3periods & 1Tut/Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Prerequisites:
Engineering mathematics, Engineering mechanics, Thermodynamics.

Course Objectives:

In the backdrop of depleting fossil fuels, the course is intended to give a overall perspective of the potential of non-conventional energy sources like solar, wind, ocean, geothermal etc. The course also attempts to stress the importance of direct energy conversion systems.

Course Outcomes:
At the end of the course the student will be able to:

CO-1	Comprehend the significance of various renewable energy sources and principles of solar radiation.
CO-2	Explain the various applications of solar energy like heating, power generation, and refrigeration.
CO-3	Describe the nuances of technology involved in harnessing wind energy for power generation and principles of bio-gas generation.
CO-4	Illustrate the energy potential of oceans and geothermal sources and means of extracting it.
CO-5	Analyze the principle and importance of Direct energy conversion devices like MHD, Fuel cells etc.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1		2	2	3	1		2	1	1	1	1	1	2	3
CO-2	2	1	3	3	3		2	2	2	2	1	2	3	3
CO-3	2	1	3	3	3		1	2	2	2	2	2	2	1
CO-4	1		2	2	2			1	1	1	2	2	2	
CO-5	3	3	3	2	2		2	2	2	2	2	2	2	1

Syllabus

(L+T)

UNIT – I **(8+2)**

Introduction to Non conventional energy resources: India’s production and reserves of

Employability

commercial energy sources, need for non-conventional energy sources, energy alternatives, solar, thermal, photovoltaic. Water power, wind biomass, ocean temperature difference, tidal and waves, geothermal.

Principles of solar radiation : Solar constant, extraterrestrial and terrestrial solar radiation, direct & diffuse radiation, solar geometry, solar radiation data, solar radiation on titled surface, solar radiation measurement

Employability

UNIT-II **(10+4)**

Solar Thermal Systems Types of solar collectors-non-concentric & concentric type, flat plate collectors-performance analysis, Absorber coatings. Solar energy storage systems-types & Applications.

Solar Photovoltaic Systems Operating principles. Photovoltaic cell concepts. Cell, module, array. Series and parallel connections. Applications.

Employability & Enterpreneurship

Employability

UNIT-III **(10+4)**

Wind energy: Wind patterns and wind data. Site selection. Wind power calculations, Performance Characteristics of wind generators. Compenents and classifications of WEC systems.

Bio-mass : Operating principles. Conversion and fermentation-wet and dry processes. Photosynthesis, Bio-gas generation-Anaerobic digestion, classification of bio-gas plant.

Employability & Enterpreneurship

UNIT-IV **(10+2)**

Geothermal energy: Geothermal sources-classification-vapour, liquid dominating systems, applications..

Ocean energy: Ocean Thermal Energy Conversion (OTEC)-principles and thermodynamic cycles. Energy of tides: introduction, principles, components, operation methods, limitations of tidal power generation. wave energy conversion techniques.

Employability

Employability & Enterpreneurship

UNIT-V **(10+2)**

Direct energy conversion: Principles of DEC, Thermo-electric generators, seebeck, peltier and joule Thomson effects, Selection of materials, applications.

Magneto Hydro dynamic generators (MHD): principles, dissociation and ionization, Thermal efficiency, MHD Engine, power generation systems.

Fuel cells: Design &principle of operation, classification, types of fuels, efficiency.

Employability

TEXT BOOKS

1. G.D. Rai, *"Non-Conventional Energy Sources"*, Khanna publishers, 2004
2. Tiwari and Ghosal, *"Renewable energy resources"*, Narosa publications, 2004

REFERENCES

1. Twidell & Weir, Taylor & Francis *"Renewable Energy Sources"*, 2006
2. Sukhatme *"Solar Energy"*, Tata McGraw-Hill Education, 1996
3. Frank Krieth & John F Kreider *"Principles of Solar Energy"*.

4. Ashok V Desai *"Non-Conventional Energy",* Wiley Eastern publications,
5. John Twideu and Tony Weir *"Renewal Energy Resources"*, BSP Publications, 2006.

Web resources:

1. http://nptel.ac.in/courses/112101098
2. http://nptel.ac.in/courses/121106014/
3. http://nptel.ac.in/courses.php

CONDITION MONITORING	
MEC 422 (B)	**Credits:3**
Instruction : 3periods & 1Tut/Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Prerequisites:

Engineering mechanics, Theory of machines, Instrumentation and control systems.

Course objective:

To familiarize the students with different types and causes of failure of mechanical components and different condition monitoring techniques available for reactive, preventive & predictive maintenance types.

Course outcomes:

By the end of the course, the student will be able to:	
CO-1	Interpret various types of mechanical failures and different maintenance techniques.
CO-2	Comprehend diverse condition monitoring techniques and fault detection sensors.
CO-3	Explain and predict the causes of vibrations by using vibration monitoring techniques.
CO-4	Describe and analyze the wear debris monitoring methods.
CO-5	Apply thermography as a tool for condition monitoring and further explain the intricacies of it.

Mapping of course outcomes with program outcomes:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**		2	1	2					2	2	1	1	1	
	2		2	1	2					2	2	1	2	1	
	3	1	2	1	2	3				2	2	1	2	2	1
	4	2	2	2	2					2	1	1	2	1	1
	5	2	2	2	2	2				2	1	1	2	1	

SYLLABUS **Periods**

Employability **(L+T)**

UNIT-I **(12+1)**

Introduction about condition monitoring: Failures, Types of failures, Causes of failures, Bath tub curve, Maintenance types- Reactive, Preventive, Predictive and Proactive maintenances

UNIT-II **(14+1)**

Condition monitoring techniques: Visual monitoring, Thermography, Vibration monitoring, Shock pulse monitoring, Wear debris monitoring, Motor current signature analysis, Acoustic emission, Ultrasound monitoring, ISO standards, fault detection sensors**.**

Employability

UNIT-III **(15+2)**

Vibration monitoring: Definition, principles of vibration monitoring, causes of vibration- unbalance, misalignment, bent shaft, oil whirl, anti-friction bearings, mechanical looseness, gear problems, vibration transducer, vibration analyzer, vibration software- simple case study.

Employability

UNIT-IV **(14+1)**

Wear debris monitoring: Introduction, Types of wear, benefits of wear debris analysis, detection of wear particles – Spectroscopy, Ferrography, Particle count, common wear materials, oil sampling technique, oil analysis, limits of oil analysis

UNIT-V **(14+1)**

Thermography: Introduction, thermograms, thermal imaging devices- Optical pyrometer , Infrared cameras, use of IR camera , industrial applications of thermography - leakage detection, machineries, advantages, disadvantages and applications of thermography in condition monitoring with a case study.

Employability

Employability

Text Books:

1. Amiya R.Mohanty *Machinery condition monitoring: Principles and Practices* , CRC Press publisher (2015)
2. R.A. Collacott *Mechanical Fault Diagnosis and condition monitoring*, Springer Netherlands Publisher

Reference Books:

1. Cornelius scheffer, Paresh Girdhar *Practical Machinery vibration analysis and Predictive Maintenance* , Newnes(Elsevier)
2. Alan Davies, *Hand book of condition monitoring techniques and Methodology* , Chapman and Hall Publisher

3. J.S.Rao, *Vibratory condition monitoring of Machines*, Narosa Publishing House

Web resources:

1. https://www.youtube.com/watch?v=VbytRqnQ6kI
2. http://nptel.ac.in/courses/112103112/40
3. nptel.ac.in/courses/112105048/36
4. https://www.youtube.com/watch?v=JlD-Uec7Zmk
5. http://nptel.ac.in/courses/112105048/33

COMPUTATIONAL FLUID DYNAMICS	
MEC 422 (C)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites: Mathematics, Fluid Mechanics and Heat Transfer

Course Objectives:

To impart the knowledge of numerical techniques to the solution of fluid dynamics and heat transfer problems.

Course Outcomes:

At the end of the course the student will be able to:

CO-1	Formulate Governing Equations of fluid dynamics and analyze their mathematical behavior.
CO-2	Apply the Finite Difference and Finite volume methods for solving simple one, two and three dimensional diffusion problems.
CO-3	Apply Finite volume method for solving steady one dimensional convection-diffusion problems.
CO-4	Apply Finite volume method for flow field analysis.
CO-5	Explain the various turbulence models and mesh generation techniques.

Mapping of Course Outcomes with Programme Outcomes.

High-3, Medium-2, Low-1

COURSE OUTCOMES	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**		**1**		**2**	**3**	**2**		**1**	**1**	**1**
CO2	**2**	**3**	**1**	**2**		**2**	**2**			**1**	**1**	**2**
CO3	**2**	**3**	**2**	**1**	**1**	**1**	**2**	**3**		**3**	**1**	**1**
CO4	**2**	**2**	**1**	**1**		**2**	**3**	**1**		**2**	**1**	**1**
CO5	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**1**		**1**	**1**	**1**

SYLLABUS

Periods

(L +T)

UNIT I **(10+2)**

GOVERNING EQUATIONS AND BOUNDARY CONDITIONS

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behavior of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations**.**

Employability

UNIT II

FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION **(10+2)**

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods**.**

Employability

UNIT III

FINITE VOLUME METHOD FOR CONVECTION AND DIFFUSION **(10+2)**

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

Employability

UNIT IV

FLOW FIELD ANALYSIS **(10+2)**

Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

Employability

UNIT V

TURBULENCE MODELS AND MESH GENERATION (10+2)

Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

Employability

TEXT BOOKS:

1. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd.Second Edition – 2007.

2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.

REFERENCES:

1. Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation, 2004.
2. Chung, T.J., "Computational Fluid Dynamics", Cambridge University, Press, 2002.
3. Ghoshdastidar P.S., "Heat Transfer", Oxford University Press, 2005
4. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995.
5. ProdipNiyogi, Chakrabarty, S.K., Laha, M.K. "Introduction to Computational Fluid Dynamics", Pearson Education, 2005. 6. Anil W. Date, "Introduction to Computational Fluid Dynamics", Cambridge University Press, 2005.

Web Resources:

http://nptel.ac.in/courses/112105045/

STATISTICAL QUALITY CONTROL	
MEC 422(D)	**Credits:**
Instruction : 3periods & 1Tut/Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Prerequisites: ---

Course objectives: To acquaint the students with the basic knowledge of statistical quality control and explain the construction of control charts for variables and attributes. To analyze performance of the control charts and capability of a process. To instruct acceptance sampling plans and use of Dodge-Romig tables.

Course outcomes:

By the end of the course, the student will be able to:	
CO-1	Comprehend the basic knowledge of statistical quality control such as definitions of quality, off-line and on-line quality control techniques, Deming's philosophy, quality costs, Taguchi's loss function and six sigma concepts.
CO-2	Produce the control charts for variables, analyze their performance and can evaluate process performance.
CO-3	Analyze and make conclusions about the process capability.
CO-4	Use the control charts for attributes and can conclude about the process control.
CO-5	Design, apply and analyze the sampling plans and will be able to judge the quality of the products or the process that produces the products.

Mapping of course outcomes with program outcomes:

		PO												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO	**1**	2	2	3	3	2	3	3	1	3	2	3	3	2	2
	2	3	3	3	3	3	3	3	1	3	2	3	3	3	3
	3	3	3	3	3	3	3	3	1	3	2	3	3	3	3
	4	3	3	3	3	3	3	3	1	3	2	3	3	3	3
	5	3	3	3	3	3	3	3	1	3	2	3	3	3	3

SYLLABUS **Periods (L+T)**

UNIT-I **(11+1)**

Introduction to quality: Definitions and dimensions of quality; Deming's quality philosophy; Quality costs; Examples of off-line and on-line quality control techniques; Taguchi's loss function; Introduction to six sigma concept.

Employability

UNIT-II **(10+4)**

Control charts for variables: Shewhart's normal bowl; $\bar{x}$, R and σ control charts; Type-I and Type-II errors; Theory of runs - ARL and ATS.

UNIT-III **(5+1)**

Process capability analysis: Process capability analysis using frequency distribution; Process capability analysis using control charts; Process capability analysis using process capability ratios - C_p and C_{pk}; Process capability ratios for nominal the better type, smaller the better type and larger the better type product specifications.

UNIT-IV **(10+4)**

Control charts for attributes: p chart, standardized p chart, np chart, c chart, u chart, ku chart, and demerit control chart.

Employability

Employability

UNIT-V **(10+4)**

Acceptance sampling plans: Single, double, multiple and sequential sampling plans; Design of single and sequential sampling plans; Rectifying inspection - AOQ, AOQL, and ATI; Use of Dodge Romig tables.

Text Books:

1. A. Mitra, "*Fundamentals of Quality Control and Improvement",* John Wiley,2008.
2. M. Mahajan, "*Statistical Quality Control",* Dhanpatrai & Co, 2016.

Reference Books:

1. D. C. Montgomery, *"Introduction to Statistical Quality Control"*, John Wiley & sons, 2009.
2. E.L. Grant, *" Introduction to Statistical Quality Control",* Tata Mc-Graw Hill Co. Ltd, 2000.

Web Resources:

1. http://www.nptel.ac.in
2. http://www.freevideolectures.com

MECHATRONICS	
MEC 422 (E)	**Credits:3**
Instruction : 3periods & 1Tut/Week	Sessional Marks :40
End Exam : 3hrs	End Exam Marks: 60

Prerequisites:

Engineering mechanics, Basic Electronics.

Course objective:

To familiarize the students the importance of industrial automation and various modelling and simulation techniques. Further introduce them to the application of electronics and electrical principles to mechanical systems.

Course outcomes:

By the end of the course, the student will be able to:	
CO-1	Explain mechatronics key elements, advanced approaches in mechatronics & mechatronics design process.
CO-2	Develop the block diagrams of various electro mechanical systems.
CO-3	Explain the working of different types of sensors and transducers
CO-4	Explain the installation procedure of I/O card and software.
CO-5	Compare and contrast the applications of sensors in mechatronics systems.

Mapping of course outcomes with program outcomes:

	PO											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO 1							1		1	1	2	
CO 2							1		1	1	2	
CO 3				1			1		1	1	2	
CO 4	2						1		1	1	2	
CO5			2	1			1		1	1	2	

SYLLABUS **Periods (L+T)**

UNIT-I **(5+1)**

Introduction to Mechatronics:

Integrated design issues in mechatronics, Mechatronics key elements, the mechatronics design process, advanced approaches in mechatronics.

Employability

UNIT-II **(8+4)**

Modeling and simulation of physical systems:

Simulation and block diagrams, Analogies and impedance diagrams, Electrical systems, Mechanical translational systems, Mechanical rotational systems, electromechanical coupling, Fluid systems.

UNIT-III

Employability **(12+4)**

Sensors and transducers:

An introduction to sensors and transducers, Sensors for motion and position measurement, Force, torque and tactile sensors, Flow sensors, Temperature sensing devices. Actuating devices: Direct current motor, Permanent magnet stepper motor, Fluid power actuation.

UNIT-IV **(8+4)**

Real time interfacing:

Introduction, Elements of a data acquisition and control system, Overview of the I/O process, Installation of the I/O card and software.

UNIT-V Employability **(10+4)**

Advanced applications in mechatronics:

Sensors for condition monitoring, Mechatronic control in automated manufacturing, Artificial intelligence in mechatronics, Microsensors in mechatronics.

Employability

Employability

Text Books:

1. Devdasshetty, Richard A. Kolk, “Mechatronics System Design”, 2nd Edition ,Cengage Learning 2011.
2. Georg pelz, "Mechatronic Systems: Modeling and simulation" with HDL’s, John wiley and sons Ltd, 2003

Reference Books:

1. Bishop, Robert H, "Mechatronics Hand book", CRC Press, 2002.
2. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991 , First Indian print 2010.
3. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint, 2013

Web resources:

1. http://nptel.ac.in/downloads/112103174/

PROJECT (PHASE-II)	
MEC 423	**Credits:8**
Instruction : 12 Practical	Sessional Marks :100
End Exam : Viva-voce	End Exam Marks:100

In the second phase of the project work, the student should continue the work from the stage where he has left in the phase-I and complete it.

The evaluation of Phase-II of the project work is based on both internal and external examination. The internal evaluation is done in the mid and also at the end of the semester, Where in the student has to give a PowerPoint presentation followed by Viva – voce.

The external examination is also based on similar lines in the presence of both internal and external examiners.

SYLLABUS FOR M. TECH. (CONTROL SYSTEMS ENGINEERING)

SEMESTER – I

ECS 111: SYSTEMS & CONTROL

Credits : 4
Lectures per week : 4
Univ. Exam. Marks : 60
Sessional Marks : 40
Total Marks : 100

UNIT-I:
Transfer functions of linear systems-impulse response of linear systems- -signal flow graphs-reduction techniques for complex block diagrams and signal flow graphs.

UNIT-II:
Mathematical modeling of physical systems-equations of electrical networks-modeling of mechanical systems- equations of mechanical systems.

UNIT-III:
Time domain analysis of control systems- time response of first and second order systems with standard input signals-steady state performance of feedback control systems-steady state error constants-effect of derivative and integral control on transient and steady state performance of feedback control systems.

UNIT-IV:
Concept of stability and necessary conditions for stability-Routh-Hurwitz criterion, relative stability analysis, the concept and construction of root loci, analysis of control systems with root locus.

UNIT-V:
Correlation between time and frequency responses- Polar plots- Bode plots-Log magnitude versus phase plots-all pass and minimum phase systems-Nyquist stability criterion- assessment of relative stability-constant M&N circles.

Text books:

1. Control systems engineering by I.J. Nagrath & M.Gopal, wiley eastern limited.
2. Automatic control systems by Benjamin C. Kuo, prentice hall of India.

Reference book:

1. Modern control engineering by Ogata, prentice hall of India.

2015-16/426, 2016-17/430, 2017-18/419,2018-19/442,2019-20/440

ECS 112: ENGINEERING OPTIMIZATION

Credits	: 4
Lectures per week	: 4
Univ. Exam. Marks	: 60
Sessional Marks	: 40
Total Marks	: 100

UNIT-I:
Introduction to Optimization: Introduction, Historical Development, Engineering Applications of Optimization, Statement of Optimization Problem.

UNIT-II:
Classical Optimization Techniques: Introduction, Single variable optimization, Multivariable optimization with no constraints; Multivariable optimization with Equality constraints – Solution by Direct Substitution method, Method of constrained variation, Method of Lagrangian multipliers; Multivariable optimization with inequality constraints: Kuhn-Tucker conditions.

UNIT-III:
Linear Programming: Introduction, Applications of Linear Programming, Standard Form of a Linear Programming, Basic Terminology and Definitions, Exceptional cases, Simplex method, Big-M method, Two- phase method, Revised Simplex method, Duality, Decomposition Principle.

UNIT-IV:
Non-Linear Programming-I: Unconstrained optimization-Univariate method, Pattern Directions, Hook and Jeeves Method, Powell's method, Gradient of a function, Steepest descent method, Conjugate Gradient Method, Newton’s method, Marquardt Method, Quai-Newton Methods, Davidon-Fletcher-Powell Method, Broyden-Fletcher-Goldfarb-Shanno Method.

UNIT-V:
Non-Linear Programming-II: Constrained optimization- Characteristics of a Constrained Problem, Sequential linear programming, Basic approach in the methods of feasible directions, Zoutendijk’s method of feasible directions, Sequential Quadratic Programming.

TEXT BOOK:

1. Engineering Optimization: Theory and Applications' By S.S.Rao, New Age International Publishers, Revised Third Edition,2005.

ECS 113: ADVANCED DRIVES & CONTROL

Credits	: 4
Lectures per week	: 4
Univ. Exam. Marks	: 60
Sessional Marks	: 40
Total Marks	: 100

UNIT-I:
DC Drives: Introduction to four-quadrant operation, motor rating, motor mechanism dynamics, 1-ph fully controlled converter and chopper fed separately excited dc motor, effect of armature current waveform, torque pulsations. Dual converter fed separately excited dc motor.

UNIT-II:
Machine Modeling: Fundamentals of machine modelling. Modelling of separately excited dc motor. Park's transformation. Dynamic dq modelling of 3-ph induction motor and 3-ph synchronous motor.

UNIT-III:
Induction Motor Control: Scalar control techniques of 3–ph induction motor: Variable Voltage, Variable frequency, Variable voltage and variable frequency with constant v/f ratio, Rotor resistance control. Slip power recovery schemes. Comparison between VSI and CSI. (Using Power Electronic Converters).

UNIT-IV:
Vector Control & DTC of Induction Motor: Direct and Indirect vector control, sensor less vector control, direct torque and flux control.

UNIT-V:
Synchronous Motor Drives: Permanent magnet materials and their properties,
Synchronous reluctance, sinusoidal and trapezoidal back emf permanent magnet motors, wound field machine drives, switched reluctance motor drives.

Text Books:
1. B. K. Bose, "Modern Power Electronics and AC drives", Pearson Education, Asia, 2003.
2. G. K. Dubey, "Fundamentals of Electrical Drives", Narosa Publishing house.
3. Power Electronics: converters, applications and design Ned Mohan 2nd edition john wiley sons Inc Nov 2002.
4. R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control", PH, 1998.

Reference Books:
1. V. Subrahmanyam, "Electric Drives-Concepts and Applications", TMH.
2. G. K. Dubey, "Power Semiconductor controlled drives", PH 1989.
3. P. Vas, "Sensor less vector and direct torque control", Oxford Press, 1998.
4. W. Leonard, "Control of Electric Drives", Springer Verlag, 1985.
5. M. H. Rashid, "Power Electronics", Third Edition, PHI.
6. Generalized Theory of Electrical Machines By Dr.P.S. Bhimbra, Khanna Publications.

ECS 114: CONTROL SYSTEM COMPONENTS:

Credits	**: 4**
Lectures per week	**: 4**
Theory, Univ. Exam. Marks	**: 60**
Sessional Marks	**: 40**
Total Marks	**: 100**

UNIT-I:

Gyroscopes and Potentiometers: Working of gyroscopes, types of gyroscopes and their generalized mathematical model, applications of horizontal and vertical gyroscopes . Types of potentiometers, applications of potentiometers and selection of potentiometers.

UNIT-II:

Tachometers and Synchros: Construction details, e.m.f equation of tachometers, types of tachometers, characteristics of tachometers, tachometer applications. Constructional details and working of Synchros, Principles of Resolvers and Decoders,

UNIT-III:

Stepper Motors and Servomotors: Working principle of Stepper motor, types – permanent magnet stepper motor, reluctance type stepper motor, hybrid stepper motor, Applications of stepper motor. Servomotors types, DC servomotors, AC servomotors – transfer functions, speed control methods (armature controlled & field controlled).

UNIT-IV:

Magnetic Amplifiers and Servo Amplifiers: construction, types of magnetic amplifiers – series, parallel and self saturated magnetic amplifiers, Characteristics of magnetic amplifiers, features of servo amplifiers, DC and AC servo amplifiers.

UNIT-V:

MEMS and Accelerometers: Introduction to MEMS, definitions, classification and applications. Introduction to the Accelerometer and types of accelerometers.

TEXT BOOK:

1. Gibson T.E. and Tetuer F.B, "Control System Components", McGraw Hill, New York 1993.

REFERENCE BOOKS:

1. Greenwood, "Mechanical details of product design", McGraw Hill, New York, 1990.
2. Nadim Maluf and Kirt Williams "An Introduction to Micro electro mechanical Systems Engineering" Second edition

2015-16/429, 2016-17/433, 2017-18/421,2018-19/445,2019-20/443

ECS 115: DIGITAL CONTROL SYSTEMS

Credits : 4
Lectures per week : 4
Univ. Exam. Marks : 60
Sessional Marks : 40
Total Marks : 100

UNIT-I:
Discrete –Time Systems: Why Digital Control?, The Structure of a Digital Control System, Analog Systems with Piecewise Constant Inputs, Difference Equations, the Z-Transform, Computer-Aided Design, Z-Transform Solution of Difference Equation, The Time Response of a Discrete-Time System, The Modified Z-Transform, Frequency Response of Discrete-Time Systems, The Sampling Theorem, Resources, Problems.

UNIT-II:
Modeling of Digital Control Systems: ADC Model, DAC Model, Transfer Function of the ZOH, Effect of Sampler on Transfer Function of a Cascade, Transfer Function for the DAC, Analog Subsystem, ADC Combination, Systems with Transport Lag, the Closed-Loop Transfer Function, Analog Disturbances in a Digital System, Steady-State Error and Error Constants.

UNIT-III:
Stability of Digital Control Systems: Definitions of Stability, Stable Z-Domain Pole Locations, Stability Conditions, Stability Determination, Jury Test, Nyquist Criterion, Resources, Problems, Computer Exercises.

UNIT-IV:
State Space Representation: Discrete-Time State Space Equations, Solution of Discrete-Time State Space Equations, Z-Transfer from State Space Equations, Similarity Transformation, Resources, Problems, Computer Exercises. Stability of State Space Realizations, Controllability and Stabilizability, Observability and Detectability.

UNIT-V:
State Feedback Control: On State and Output Feedback, Pole Placement, Servo Problem, Invariance of System Zeros, State Estimation, Observer State Feedback, Pole Assignment Using Transfer Functions, Resources, Problems, Computer Exercises.

Text Books:

1. Digital Control Engineering: Analysis and Design**,** By M. Sami Fadali, Antonio Visioli, Academic Press; 1 edition (February 16, 2009)

ECS 116 (a): LARGE SCALE SY STEMS (ELECTIVE-I)

Credits : 4
Lectures per week : 4
Univ. Exam. Marks : 60
Sessional Marks : 40
Total Marks : 100

UNIT-I:
L.S.S. Modelling: Time Domain: Introduction, Aggregation methods, exact and model aggregation by continued fraction, chained aggregation descriptive variables approach, descriptive variable systems, solvability and conditionality, time invariance, shuffle algorithm.

UNIT-II:
L.S.S. Modelling - Frequency Domain: Introduction, Moment matching, Pade approximation, Routh approximation, continued fraction method, error minimization methods, mixed methods and unstable systems.

UNIT-III:
L.S.S. Modelling - Frequency Domain: Pade model method, Pade-Routh method, multi input and multi output systems, reduction, matrix continued fraction method, Model continued fraction method, Pade model method, frequency comparison method.

UNIT-IV:
Time Scales: Introduction, problem statement and preliminaries, numerical algorithm, basic properties, relation to model aggregation, feedback control design, singularly perturbed linear systems.

UNIT-V:
Singular Perturbations: Fast and slow sub systems, eigen value distribution, approximation to time scale approach, system properties, design of optimal controllers, fast and slow controllers, lower order controls.

TEXT BOOKS:

1. 'Large Scale Systems Modeling and Control', Mohammad Jamshidi,1989, North Hollard (Series in systems science and engineering, vol.9).
2. 'Large Scale Systems Modeling', Magdi S. Mohamoud and Madan G. Singh, Pergamon Press (International series on Systems and Control), 1981.

ECS 116 (b): DIGITAL SIGNAL PROCESSING (ELECTIVE-I)

Credits	: 4
Lectures per week	: 4
Univ. Exam. Marks	: 60
Sessional Marks	: 40
Total Marks	: 100

DISCRETE FOURIER TRANSFORM : DFT and its properties, Relation between DTFT and DFT, FFT computations using Decimation in time and Decimation in frequency algorithms, Overlap-add and save methods

INFINITE IMPULSE RESPONSE DIGITAL FILTERS: Review of design of analogue Butterworth and Chebyshev Filters, Frequency transformation in analogue domain - Design of IIR digital filters using impulse invariance technique - Design of digital filters using bilinear transform - pre warping - Realization using direct, cascade and parallel forms.

FINITE IMPULSE RESPONSE DIGITAL FILTERS: Symmetric and Antisymmetric FIR filters - Linear phase FIR filters - Design using Hamming, Hanning and Blackmann Windows - Frequency sampling method - Realization of FIR filters - Transversal, Linear phase and Polyphase structures.

FINITE WORD LENGTH EFFECTS: Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power - coefficient quantization error - Product quantization error - Overflow error - Roundoff noise power - limit cycle oscillations due to product roundoff and overflow errors - signal scaling

MULTIRATE SIGNAL PROCESSING: Introduction to Multirate signal processing-Decimation-Interpolation-Polyphase implementation of FIR filters for interpolator and decimator -Multistage implementation of sampling rate conversion- Design of narrow band filters - Applications of Multirate signal processing.

TEXT BOOKS:

1. John G Proakis and Manolakis, " Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fourth Edition, 2007.
2. S.Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, TMH/McGraw Hill International, 2007.
3. E.C. Ifeachor and B.W. Jervis, " Digital signal processing - A practicalapproach",Second edition, Pearson, 2002.
4. S.K. Mitra, Digital Signal Processing, A Computer Based approach, Tata Mc GrawHill, 1998.
5. P.P.Vaidyanathan, Multirate Systems & Filter Banks, Prentice Hall, Englewood cliffs, NJ, 1993.
6. Johny R. Johnson, Introduction to Digital Signal Processing, PHI, 2006.

ECS 116 (c): Data Structures (ELECTIVE-I)

2015-16/432, 2016-17/436, 2017-18/424,2018-19/448,2019-20/446

Credits : 4
Lectures per week : 4
Univ. Exam. Marks : 60
Sessional Marks : 40
Total Marks : 100

Course Objectives:

1. To teach efficient storage mechanisms of data for an easy access.
2. To design and implementation of various basic and advanced data structures.
3. To introduce various techniques for representation of the data in the real world.
4. To develop application using data structures.
5. To teach the concept of protection and management of data.
6. To improve the logical ability

Course Outcomes:

1. Student will be able to choose appropriate data structure as applied to specified problem definition.
2. Student will be able to handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
3. Students will be able to apply concepts learned in various domains like DBMS, compiler construction etc.
4. Students will be able to use linear and non-linear data structures like stacks, queues , linked list etc.

UNIT-I: Introduction to Data Structure: Types of Data Structure, Arrays, Strings, Recursion, ADT (Abstract Data type), Concept of Files, Operations with files, types of files.

UNIT-II: Linear Data Structure:
Linked List: Linked List as an ADT, Linked List Vs. Arrays, Memory Allocation & De-allocation for a Linked List, Linked List operations, Types of Linked List, Implementation of Linked List, Application of Linked List polynomial, sparse matrix.

UNIT-III: STACK: The Stack as an ADT, Stack operation, Array Representation of Stack, Link Representation of Stack, Application of stack – Recursion, Polish Notation.

UNIT-IV: Queues: The Queue as an ADT, Queue operation, Array Representation of Queue, Linked Representation of Queue, Circular Queue, Priority Queue, & Dequeue, Application of Queues – Johnsons Algorithm, Simulation.

UNIT-V: Non-linear Data Structure

Trees: Basic trees concept, Binary tree representation, Binary tree operation, Binary tree traversal, Binary search tree implementation, Thread Binary tree, The Huffman Algorithm, Expression tree, Introduction to multi way search tree and its creation(AVL, B-tree, B+ tree).

Graphs: Basic concepts, Graph Representation, Graph traversal (DFS & BFS)

TEXT BOOKS:

1. Data Structures A Pseudo code Approach with C, Richard F. Gilberg & Behrouz A. Forouzan, second edition, CENGAGE Learning.
2. Data Structures using C, Reema Thareja, Oxford University press.
3. Introduction to Data Structure and its Applications Jean-Paul Tremblay, P. G. Sorenson.

Reference Books:

1. Data Structures Using C & C++, Rajesh K. Shukla, Wiley- India.
2. Data Structures Using C, ISRD Group, Second Edition, Tata McGraw-Hill.
3. Data Structure Using C, Balagurusamy

2015-16/433, 2016-17/437, 2017-18/425,2018-19/449,2019-20/447- Control systems Lab

2015-16/433, 2016-17/437, 2017-18/425,2018-19/449,2019-20/447

ECS 118: CONTROL SYSTEMS SIMULATION LAB-I
Credits : 2
Duration per week : 3
Univ. Exam. Marks : 50
Sessional Marks : 50
Total Marks : 100

List of experiments

1. Compensation network
2. DC motor speed control demonstration unit
3. DC position control system
4. DC servo motor speed torque characteristics
5. Linear System Simulator
6. Magnetic Amplifier
7. Temperature control using P,PI, PD and PID controller
8. PIC Microcontroller Based speed control of BLDC motor
9. Speed Torque characteristics of AC Servo Motor
10. Synchro transmitter and Receiver pair
11. Observe motor Characteristics using Feedback Unit.

SYLLABUS FOR M. TECH. (CONTROL SYSTEMS ENGINEERING)

SEMESTER – II

2015-16/434, 2016-17/438, 2017-18/426,2018-19/450,2019-20/448

ECS 121: ADVANCED CONTROL SYSTEMS

Credits	: 4
Lectures per week	: 4
Univ. Exam. Marks	: 60
Sessional Marks	: 40
Total Marks	: 100

UNIT-I:

State variable representation: Introduction-Concept of State-State equation for Dynamic Systems-Time invariance and linearity-No uniqueness of state model-State Diagrams-Physical System and State Assignment.

UNIT-II:

Solution of state equation: Existence and uniqueness of solutions to Continuous-time state equations-Solution of Nonlinear and Linear Time Varying State equations- Evaluation of matrix exponential-System modes-Role of Eigenvalues and Eigenvectors.

UNIT-III:

Controllability and Observability: Controllability and Observability-Stabilizability and Detectability-Test for Continuous time Systems- Time varying and Time invariant case-Output Controllability-Reducibility- System Realizations.

UNIT-IV:

Stability: Introduction-Equilibrium Points-Stability in the sense of Lyapunov-BIBO Stability-Stability of LTI Systems-Equilibrium Stability of Nonlinear Continuous Time Autonomous Systems-The Direct Method of Lyapunov and the Linear Continuous-Time Autonomous Systems-Finding Lyapunov Functions for Nonlinear Continuous Time Autonomous Systems-Krasovskii and Variable-Gradiant Method.

UNIT-V:

Modal control: Introduction-Controllable and Observable Companion Forms-SISO and MIMO Systems-The Effect of State Feedback on Controllability and Observability-Pole Placement by State Feedback for both SISO and MIMO Systems-Full Order and Reduced Order Observers.

TEXT BOOKS:

1. M. Gopal, "Modern Control System Theory", New Age International, 2005.
2. K. Ogatta, "Modern Control Engineering", PHI, 2002.

REFERENCES:

1. John S. Bay, "Fundamentals of Linear State Space Systems", McGraw-Hill, 1999.
2. D. Roy Choudhury, "Modern Control Systems", New Age International, 2005.
3. John J. D'Azzo, C. H. Houpis and S. N. Sheldon, "Linear Control System Analysis and Design with MATLAB", Taylor Francis, 2003.
4. Z. Bubnicki, "Modern Control Theory", Springer, 2005.

ECS 122: NON-LINEAR CONTROLSYSTEMS

Credits : 4
Lectures per week : 4
Univ. Exam. Marks : 60
Sessional Marks : 40
Total Marks : 100

UNIT-I:
Introduction to Non-Linear System: Classification of non-linearity, types of non-linearity in physical system, jump phenomena and critical jump resonance curve, methods of analysis of non-linear systems and comparison, isoclines, singular point, limit cycle.

UNIT-II:
Phase Plane Analysis: Concept of phase plane, phase trajectory, phase portraits, methods of plotting phase plane trajectories Vander Pol's equation, stability from phase portrait, time response from trajectories, isoclines method, Pell's method of phase trajectory, and Delta method of phase trajectory construction.

UNIT-III:
Frequency Domain Analysis: Absolute stability, Describing function, DF of typical nonlinearities stability analysis using DF method, stability studies using DF method.

UNIT-IV:
Liapunov Stability: Autonomous Systems: Stability of equilibrium point. Concepts of positive definite/semi definite, negative definite/ semi definite, indefinite functions, Lyapunov function, Liapunov Stability: asymptotic stability, global asymptotic stability, instability.

UNIT-V:
Linearization: Linear systems, linearization of nonlinear systems about equilibrium point, **f**eedback linearization and input/output linearization.

TEXT BOOK:

1. M.Vidyasagar, 'Nonlinear systems Analysis', 2nd Edition, 1991, prentice-Hall Inc.

REFERENCE BOOK:

1. Control Systems Theory and Application: Samarjit Ghosh, Pearson Education
2. Control System Engineering: Nagrath and Gopal, Wiley Eastern
3. Automatic Control System: George J. Thaler Brown, Jaico Publications
4. Nonlinear Systems: Hasan A. Khalil, Printece Hall of India

ECS 123: ADVANCED CONTROL SYSTEM DESIGN

Credits	: 4
Lectures per week	: 4
Univ. Exam. Marks	: 60
Sessional Marks	: 40
Total Marks	: 100

UNIT-I:

Design of Linear Control Systems: Review of compensation technique and choice of optimum parameters to obtain desired performance, Reshaping of Polar, Bode, Root locus plots to obtain desired response, Initial condition and forced response, a simple lag – lead design.

UNIT-II:

Integral-square error compensation: parameter optimization using Integral-square error criterion with and without constraints, State variable Feedback compensation of continuous - time and discrete-time systems.,

UNIT-III:

MIMO Control design: Matching Based on Linear Quadratic Optimal Regulators, Discrete Time Optimal Regulators, Connections to Pole Assignment, Observer Design, Linear Optimal Filters, State Estimate Feedback, Transfer Function Interpretation, Achieving Integral Action in LQR Synthesis, Industrial Applications.

UNIT-IV:

PID Controller: Tunable PID controller, Ziegler – Nichol's method, Simulation of multi-loop control system using P, PI, PD, PID controller and finding the system response. Standard compensator structures (P, PD, PI and PID control).

UNIT-V:

Design of digital control system: Digital controller design, Regulator and observer design, Digital servo for inverted pendulum. Classical Compensation of Discrete-time control systems: Forward path continuous, Forward-path Digital, Z-plane Synthesis approaches, Deadbeat performance.

Text Books:

1. G. C. Goodwin, S. F. Graebe, M. E. Salgado, "Control System Design", Prentice Hall of India
2. Gupta and Hasdorf, 'Fundamentals of Automatic control Willey Eastern, 1970.
3. B.C.Kuo, Automatic control systems' (5th Edition), Prentice Hall of India, 1988.

Reference Books:

1. M. Gopal, "Digital Control and State Variable Method", Tata McGraw Hill
2. Hadi Saadat, "Computational Aids in Control System Using MATLAB", McGraw Hill International
3. Ogata K., "Modern Control Engineering", 4th Edition, Prentice Hall
4. Ogata K. "System Dynamics", 3rd Edition, Prentice Hall
5. M. Gopal, "Control Systems Principles and Design", 2nd Edition, Tata McGraw Hill
6. Norman S. Nise, "Control Systems Engineering", 3rd Edition, Wiley
7. George Ellis, "Control System Design Guide – A Practical Guide", 3rd Edition, Academic Press

ECS 124: INTELLIGENT SYSTEMS AND CONTROL

Credits : 4
Lectures per week : 4
Univ. Exam. Marks : 70
Sessional Marks : 30
Total Marks : 100

UNIT-I:

Neural Networks: Artificial Neural Networks: Basic properties of Neurons, Neuron Models, Feedforward networks – Perceptrons, Multilayer networks – Exact and approximate representation, Back propagation algorithm, variants of Back propagation, representation of supervised, Unsupervised and Reinforcement learning; Competitive learning and self organizing networks. [Text: 1]

UNIT-II:

ANN based control: Introduction, Representation and identification, modeling the plat, control structures – supervised control, study-application to electrical engineering. [Text: 3 chaper 6]

UNIT-III:

Fuzzy Logic: Overview of classical logic, Fuzzy sets vs Crisp set, Membership function, Methods of Membership function, Value Assignment, Defuzzification – Methods of defuzzification, fuzzy rule based and Approximation, Aggregation of Fuzzy rules, Fuzzy inference system –Mamadani and Sugeno methods. [Ref: 2 & 9]

UNIT-IV:

Fuzzy Controllers: Preliminaries – Basic architecture and operation of Fuzzy controller – Analysis of static properties of fuzzy controller – Analysis of dynamic properties of fuzzy controller – application to electrical engineering (PID Controllers for Servo Mechanic Systems). [Ref: 2,8 & 11]

UNIT-V:

Neuro–Fuzzy Controllers: Hybrid systems, Fuzzy logic in learning algorithm, fuzzy neurons, NN as Pre-processors, Architecture based on Back propagation, Adaptive neuro-fuzzy Inference systems (ANFIS). [Ref: 7 Chapter:17]

TEXT BOOKS:

1. Bose and Liang, Artificial Neural Networks, Tata Mcgraw Hill, 1996.
2. Kosco B, Neural Networks and Fuzzy Systems: A Dynamic Approach to Machine Intelligence, Prentice Hall of India, New Delhi, 1992.
3. George William Irwin, K. Warwick, Kenneth J. Hunt: Neural Network Applications in Control Institution of Electrical Engineers, London, United Kingdom, 1995.

REFERENCES:

4. Klir G.J and Folger T.A, Fuzzy sets, Uncertainty and Information, PHI, New Delhi 1994.
5. Simon Haykin, Neural Networks, ISA, Research Triangle Park, 1995.
6. Bose, Nirmal K.; Bose, N. K.; Liang, Ping, Neural Network Fundamentals with Graphs, Algorithms, and Applications (McGraw-Hill Series in Electrical & Computer Engineering)

7. R.Alavala Chennakesava, "Fuzzy logic and NN based concepts and applications", New age International publishers, 1998.
8. Fuzzy logic with Fuzzy Applications – T.J.Ross – Mc Graw Hill Inc, 1997.
9. S.N. Sivanandam, S. Sumathi and S.N. Deepa,; Introduction to Fuzzy Logic using MATLAB, Springer, 2007.
10. Ernest Czogala, Jacek Lesk , Fuzzy and Neuro-Fuzzy Intelligent Systems, Springer, 2000.
11. G. Chen, Introduction to Fuzzy sets, Fuzzy logic, fuzzy systems, CRC Press, Boca Raton Landon New York Washington, D.C. 2001.

ECS 125: OPTIMAL & ADAPTIVE CONTROL

(COMMON FOR POWER SYSTEMS AND AUTOMATION & CONTROL SYSTEM ENGINEERING)

Credits	**: 4**
Lectures per week	: **4**
Univ. Exam. Marks	: **60**
Sessional Marks	: **40**
Total Marks	: **100**

Part I: Optimal Control

UNIT I

Introduction - Problem formulation- State variable representation of systems – Performance measures for optimal control problems–selecting a performance measure. Dynamic programming – optimal control law – principal of optimality – discrete linear regulator problems -Hamilton- Jacobi-Bellman equation- continuous linear regulator problem.

UNIT II

The Calculus of variations: Fundamental concepts- the fundamental theorem of the calculus of variations - Functional of a single function- the simplest variational problem .

UNIT III

The variational approach to optimal control problems-Necessary conditions for optimal control - Linear regulator problem pontryacyn's minimum principle and state inequality constraints

Part II: Adaptive Control

UNIT IV

Introduction what is Adaptive control? Effect of process variations–Adaptive Schemes–Adaptive control problem Model Reference Adaptive Control- Motivational Example, Introduction to Direct Model Reference Adaptive Control, Direct Model Reference Adaptive Control of Scalar Linear Systems with Parametric Uncertainties.

UNIT V

State Feedback Direct Model Reference Adaptive Control: Introduction, Command Tracking, Direct MRAC Design for Scalar Systems, Dynamic Inversion MRAC Design for Scalar Systems.

TEXT BOOK:

1. Optimal control theory-An Introduction by Donald E.Kirk - Prentice Hall Networks series.

2. Robust and Adaptive Control: With Aerospace Applications, Advanced textbooks in control and signal processing, by Eugene Lavretsky, Kevin A. Wise, publisher Springer 2012.

ECS 126 (a): SLIDING MODE CONTROL (ELECTIVE - II)

Credits	**: 4**
Lectures per week	: **4**
Univ. Exam. Marks	: **60**
Sessional Marks	: **40**
Total Marks	: **100**

UNIT-I:

An Introduction to Sliding Mode Control: Introduction, properties of sliding motion, typical controller design, pseudo-sliding with a smooth control action, a state-space approach

UNIT-II:

Sliding mode control: Introduction, problem statement, existence of solution and equivalent control properties of the sliding motion, The reachability problem, the unit vector approach, continuous approximations.

UNIT-III:

Sliding mode Design approaches: Introduction, A regulator form based approach, a direct eigenstructure assignment approach, Incorporation of a tracking requirement, Design study of Pitch- pointing flight controller.

UNIT-IV:

Sliding mode controllers using output information: Introduction, problem formulation, a special case of square plants, a general frame work, dynamic compensation, observer based dynamic compensation, a model reference system using only outputs.

UNIT-V:

Sliding mode observers: Introduction, sliding mode observers, synthesis of a discontinuous observer, the Walcott-Zak observer revisited, sliding mode observers for fault detection

TEXT BOOK:

1. Sliding Mode Control: Theory And Applications (Series in Systems and Control) by C Edwards and S Spurgeon, Published by Taylor & Francis,

REFERENCE:

1. Sliding Mode Control In Engineering (Automation and Control Engineering) by Wilfrid Perruquetti , Jean-Pierre Barbot published by Marcel Dekker, Inc, New York

ECS 126 (b): ROBOTICS (ELECTIVE- II)

Credits : **4**
Lectures per week : **4**
Univ. Exam. Marks : **60**
Sessional Marks : **40**
Total Marks : **100**

UNIT-I:
Fundamentals of Robot Technology: Basic structure, links and Joints, types of Joints, types of links, types of end effectors: Grippers: Mechanical, Vacuum cups, Magnetic, adhesive and miscellaneous. Tools as end effectors. Wrist configuration: concept of: yaw, pitch and roll.

UNIT-II:
Robot classification: according to 1) Co-ordinate system: Cartesian, cylindrical, spherical, SCARA, Articulated 2) Control Method: Servo controlled and non-servo controlled, their comparative study 3) Form of motion: P-T-P (point to point), C-P (continuous path), pick and place etc. and their comparative study 4) Motion conversion: Rotary to rotary, rotary to linear and vice versa.

UNIT-III:
Robot arm dynamics: Newton Euler Equations, Kinetic and potential energy, Lagrangian analysis for a single prismatic joint working against gravity and single revolute joint. Joint vector, homogeneous co- ordinates. Matrix operators for translation and rotation

UNIT-IV:
Robot Control: Open loop and closed loop control, Linear control Schemes, PD and PID control, Torque and Force control of robotic manipulators, Adaptive control, Hybrid control, Impedance control. Manipulator Jacobian, Jacobian for prismatic and revolute joint. Jacobian Inverse, Singularities, Control of Robot manipulator: joint position controls (JPC), resolved motion position controls (RMPC) and resolved motion rate control (RMRC)

UNIT-V:
Industrial Applications: Industrial Applications of Robots: Welding, Spray-painting, Grinding, Handling of rotary tools, Parts handling/transfer, Assembly operations, parts sorting, parts inspection, Potential applications in Nuclear and fossil fuel power plant etc.

TEXT BOOKS:

1. R. K. Mittal, I. J. Nagrath, "Robotics and Control", Tata McGraw Hill Publishing Company Ltd., New Delhi.

REFERENCE BOOKS:

1. Arthur J. Critchlow, "Introduction to Robotics"
2. Robert J. Schilling, "Fundamentals of Robotics: Analysis and Control", Prentice Hall of India, New Delhi
3. John J. Craig, "Introduction to Robotics: Mechanics and Control", Pearson Education
4. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, "Industrial Robotics: Technology, Programming and Applications", McGraw Hill Book Company
5. Richard D. Klafter, Thomas A. Chemielewski, Michael Neign "Robotic Engineering – An Integral Approach", Prentice Hall of India Pvt. Ltd., New Delhi. Eastern Economy Edition.
6. K. S. Fu., R. C. Gonzalez, C. S. G. Lee, "Robotics: Control Sensing, Vision and Intelligence", International Edition, McGraw Hill Book Co.

ECS 126 (c): PROCESS CONTROL & AUTOMATION (ELECTIVE- II)

Credits	**: 4**
Lectures per week	: **4**
Univ. Exam. Marks	: **60**
Sessional Marks	: **40**
Total Marks	: **100**

UNIT-I:

Process Modeling- Introduction to Process control and process instrumentation-Hierarchies in process control systems-Theoretical models-Transfer function-State space models-Time series models-Development of empirical models from process data-chemical reactor modeling-. Analysis using MATLAB & SIMULINK.

UNIT-II:

Feedback & Feed forward Control- Feedback controllers-PID design, tuning, trouble shooting-Control system design based on Frequency response Analysis-Direct digital design-Feed forward and ratio control-State feedback control- LQR problem- Pole placement -Simulation using MATLAB & SIMULINK-Control system instrumentation-Control valves- Codes and standards- Preparation of P& I Diagrams.

UNIT-III:

Advanced process control-Multi-loop and multivariable control-Process Interactions-Singular value analysis-tuning of multi loop PID control systems-decoupling control-strategies for reducing control loop interactions-Real-time optimization-Simulation using MATLAB & SIMULINK.

UNIT-IV:

Model predictive control-Batch Process control-Plant-wide control & monitoring- Plant wide control design

UNIT-V:

Instrumentation for process monitoring-Statistical process control-Introduction to Fuzzy Logic in Process Control-Introduction to OPC-Introduction to environmental issues and sustainable development relating to process industries. Comparison of performance different types of control with examples on MATLAB and SIMULINK.

Textbooks

1. Seborg, D.E., T.F. Edgar, and D.A. Mellichamp, Process Dynamics and Control, John Wiley , 2004
2. Johnson D Curtis, Instrumentation Technology, (7th Edition) Prentice Hall India, 2002.

References

1. Bob Connel, Process Instrumentation Applications Manual, McGrawHill, 1996.
2. Edgar, T.F. & D.M. Himmelblau, Optimization of Chemical Processes, McGrawHill Book Co, 1988.
3. Macari Emir Joe and Michael F Saunders, Environmental Quality Innovative Technologies 7 Sustainable Development, American Society of Civil Engineers, 1997.
4. Nisenfeld(Ed) batch Control, Instrument Society of America, 1996.
5. Sherman, R.E.(Ed), Analytical instrumentation, Instrument Society of America, 1996.
6. Shinskey, F.G., Process Conrol Systems: Applications, Design and Tuning(3rd Edition) McGrawHill Book Co, 1988.

2015-16/443, 2016-17/446, 2017-18/434,2018-19/458,2019-20/456

ECS 128: CONTROL SYSTEMS SIMULATION SIMULATION LAB-I
Credits : 2
Duration per week : 3
Univ. Exam. Marks : 50
Sessional Marks : 50
Total Marks : 100

List of Experiments

1. Conversion of transfer function to signal flow graph
2. Transfer function from block diagram
3. Check for stability
4. Time domain specifications
5. Time & Frequency Response
6. Lag compensation
7. Lead compensation
8. Z-N PID Method
9. Continuous to discrete conversion
10. Discrete step form
11. Pole placement method
12. Routh Hurwitz criteria
13. Jury stability
14. Lyapunov Stability
15. Linear Quadratic Regulator (LQR)

I SEMESTER

MTBT-111 : ADVANCED MICROBIOLOGY

Course Objectives:

To enable the students

- To understand microbial diversity
- To learn about culture media, isolation methods and preservation methods of microorganisms.
- To understand about bacterial growth and methods of control of microorganisms
- To explain the antigen-antibody interactions that offers defense mechanism.

Course Outcomes : At the end of the course student will be able to:

1. Understand the Microbial Diversity and their Characteristics.
2. Isolate and culture microorganisms.
3. utilize gained knowledge in microbiology labs and bioprocess industries.
4. gain knowledge in defense mechanisms, immunity, vaccines, antibiotics.

SYLLABUS

UNIT I

Introduction to Microbiology: Origin and evolution of microorganisms, nature and scope of microbiology, major characteristics of prokaryotes and Eukaryotes, structure and functioning of bacterial cell.

Classification of microorganisms: Major characteristics of microorganisms, concepts of Classification, classification methods, principles of nomenclature and identification, Modem trends in classification.
General features and classification of some groups of microorganisms - Algae, Fungi, Chlamydiae, Rickettsiae, Mycoplasmas, Viruses and Protozoa, economic importance of Micro-organisms.

UNIT II

Methods in microbiology: Nutritional requirements, nutritional types of bacteria, Characteristics of culture medium, type of culture media and preparation of culture media, isolation of microorganisms - general and selective methods, isolation of bacteria in pure culture, enrichment - enrichment methods, staining techniques, culture characteristics, maintenance and preservation of cultures, culture collections.

UNIT III

Reproduction and growth: Reproduction in bacteria, genetic transfer in bacteria, Bacterial growth, bacterial growth curve, growth measurement techniques, factors affecting growth, control of microorganisms by physical and chemical methods.

UNIT IV

Epidemiology and infectious diseases: Epidemiological markers, role of host in infectious diseases - Air borne, water borne and food borne diseases.

UNIT V

Immunology: Natural resistance, internal defense mechanisms, non-specific defense mechanisms, immunity, types of immunity, immune systems, antibody and its diversity, Hypersensitivity, transplantation, autoimmunity, AIDS and other immune deficiencies, vaccines, types of vaccines, production of vaccines and synthetic vaccines, monoclonal anti bodies and their use, antibiotics, history of antibiotics, classification and production of antibiotics, microbial toxins, types of microbial toxins, effects of microbial toxins and their control.

TEXT BOOKS:

1. Microbiology by M. J. Pelczer, E. C. S. Chan, N. R. Kries. Tata McGrew Hill publications
2. Microbiology fundamentals and applications by S. S. Purohit. Agro botanical. Publications.

REFERNCE BOOKS:

1. Microbiology by Prescott, Harley, Klein. Mc Graw-Hill publications
2. General Microbiology by Roger Y. Stainer, Edward A. Adebery, John L. Ingraham. Published by Macmillan Press LTD.

MTBT-112: ADVANCED BIOCHEMISTRY

Course Objectives:

- To study about the biomolecules and importance of biochemistry in the advanced level.
- To study the detailed structure and function of biomolecules like carbohydrates, amino acids, proteins, lipids and nucleic acids.
- To study membrane assembling, bioenergetic principles and ATP cycle.
- To study the metabolism and biosynthesis of fatty acids, DNA, RNA, and proteins.

Course Outcomes : At the end of the course student will be able to:

1. Explain the structure and functions of biomolecules.
2. Understand the biosynthesis and degradation of biomolecules.
3. Obtain knowledge in the metabolism and bioenergetic principles.
4. Carry out independent research work to improve and to invent new biomolecules and can understand new metabolic processes.

SYLLABUS

UNIT I

Carbohydrates: classification of carbohydrates, structure and properties of monosaccharides (ribose, glucose, fructose), disaccharides (maltose, lactose, sucrose) and polysaccharides (Starch, glycogen and cellulose).
Amino acids and proteins: Classification and properties of amino acids and proteins, peptide bond, structural organization of proteins: primary, secondary, tertiary and quaternary structure of proteins. Biochemical function of proteins, denaturation of proteins.

UNIT II

Lipids: Classification, structure and physiological functions of triglycerides, fattyacids, phospholipids, cerebrosides, gangliosides and cholesterol.

Nucleic Acids: Structure and properties of purines and pyrimidine bases, nucleosides, nucleotides. Structure of nucleic acids-DNA and RNA.

UNIT III

Bioenergetics:
Energetics-ATP as energy currency, biologic oxidation, structural organization and electron flow of respiratory chain, chemiosmotic theory of oxidative phosphorylation. Mitochondrial membrane transporters- shuttle systems.

UNIT IV

Metabolism Of Carbohydrates And Proteins:
Carbohydrate metabolism - Glycolysis, Glucogenesis, Citric acid cycle and Glycogen metabolism. Protein metabolism - Urea cycle, degradation of amino acids.

Fatty Acid And Nucleic Acid Metabolism:

Overview of Fatty Acid Metabolism - synthesis and degradation of fatty acids. Nucleotides - De novo and salvage pathways.

UNIT V

Central Dogma:
Biosynthesis of DNA (replication).
Biosynthesis of RNA (transcription).
Biosynthesis of proteins (translation).

Text Books:

1. Textbook of Biochemistry by Albert-Lehninger, Kalyani Publishers,Ludhiana,New Delhi.
2. Principles of Biochemistry- Lehninger,Nelson and Cox-CBS Publishers and distributors,Delhi.
3. A text book of Biochemistry by A.V.S.S.RamaRao,UBS Publishers and Distributors Ltd,NewDelhi,Chennai.
4. Fundamentals of Biochemistry-J.L.Jain,S.Chand and company Ltd. New Delhi.

MTBT-113: ADVANCED BIOCHEMICAL ENGINEERING

Course Objectives:

- To introduce enzymes, enzymatic and microbial growth kinetics
- To introduce transport of materials in biological systems with respect to mass transfer and heat transfer
- To introduce different types of bio-reactors and special reactors like animal and plant cell reactors
- To introduce immobilization and sterilization techniques.

Course Outcome: At the end of the course student will be able to

1. Determine the enzyme activity, parameters affecting activity and enzyme immobilization
2. Gain knowledge in gas liquid mass transfer, determine the K_La and know inter particle and intra particle diffusion
3. Understand working and analysis of all types of rectors
4. Know thermal death kinetics and sterilization of air and medium.

SYLLABUS

UNIT I

Enzyme Kinetics: Effects on enzyme activity, deactivation, immobilized enzymes.

UNIT II

Microbial growth kinetics: Batch growth, unstructured models, growth in continuous culture, structured models, product formation kinetics, cell immobilization.

UNIT III

Transport Phenomena: Gas-liquid Mass transfer; Theoretical models for K_{La}, interfacial area and bubble oxygen transfer, gas-liquid mass transfer of components other than oxygen. Mass transfer into solid particles: External transfer, intraparticle diffusion. Heat transfer correlations.

UNIT IV

Bioreactors: Review of various types of bioreactors used in the fermentation industry.
Multiphase bioreactors: packed bed, bubble-column, fluidized bed and trickle-bedreactors.
Alternate fermenters: new bioreactor configurations used in the fermentationtechnology.
Animal and plant cell reactor technology.

UNIT V

Sterilization: Sterilization methods, thermal death kinetics, design criterion, batch and continuous sterilization, air sterilization.

TEXT BOOK:

Shuler, M. L and F. Kargi, Bioprocess Engineering: Basic concepts, 2nd ed., Prentice Hall India, New Delhi, 2003.

REFERNCES:

1. Lee, J. M., Biochemical Engineering (e Book), Prentice Hall, Englewood Cliffs, 2001.
2. Bailey, J. E., and D. F. Ollis, Biochemical Engineering Fundamentals, 2nd edition, Mcgraw-Hill, New York, 1986.
3. Blanch, H. W., and D. S. Clark, Biochemical Engineering, Marcel Dekker, New York, 1996.
4. Swamy,A.V.N.,' Fundamentals of Biochemical Engineering' , BS publications, 2007

MTBT-114: BIOSEPARATIONTECHNOLOGY

Course Objectives:

To enable the students to

- Understand the methods to obtain pure proteins, enzymes and in general about product development R &D
- Have depth knowledge and hands on experience on Downstream processes to produce commercial therapeutically important proteins.

Course Outcomes:

Upon success completion of this course, the students will be able to:

1. Define advanced downstream processing methods for product recovery.
2. Describe the components of downstream equipment and to understand the requirements for successful operations.
3. Enhance problem solving techniques required in multi-factorial manufacturing environment in a structured and logical fashion.

UNIT I

Downstream Processing In Biotechnology:

Role and importance of downstream processing in biotechnological processes – Problems and requirements of bio product purification – Economics of downstream processing in Biotechnology, cost-cutting strategies – Separation characteristics of proteins and enzymes – size, stability, properties – Flocculation and conditioning of broth – Process design criteria for various classes of bio products (high volume, low value products and low volume, high value products) – Upstream production methods affect downstream purification strategies.

UNIT II

Physico-Chemical Basis Of Bio-Separation Processes:

Cell disruption methods for intracellular products – Physical, chemical, mechanical – Removal of insoluble, biomass and particulate debris separation techniques – Filtration at constant pressure and at constant rate – Empirical equations for batch and continuous filtration – Types of filtration - Centrifugal and cross – flow filtration – Types of filtration equipments – Centrifugation – Basic principles, design characteristics – Types of centrifuges and applications – Sedimentation.

UNIT III

Membrane Separations And Enrichment Operations:
Theory, Design consideration and configuration of membrane separation processes – Reverse osmosis, microfiltration, ultra filtration, dialysis and pervaporation – Structure and characteristics of membranes – Membrane modules – Enrichment Operations – Extraction– equipment forextraction– Aqueous two-phase extraction process – Evaporators – Types of evaporators – Adsorption isotherms and techniques – Protein precipitation – Methods of precipitation.

UNIT IV

Mechanism And Modes Of Chromatographic Separation:
Chromatography – Classification of chromatographic techniques – General description of column chromatography – Chromatographic terms and parameters – Practice of chromatography – Partition, normal-phase, displacement, reversed-phase, size exclusion, ion exchange, hydrophobic, affinity chromatography – Scale-up of chromatography – Process considerations in Preparative liquid chromatography and HPLC.

UNIT V

Finishing Operations And Formulations:
Drying – Mechanism, methods and applications, Types of dryers – Tray, spray, rotary, belt, disc – Crystallization – Nucleation , growth – Types of crystallizers – Tank, scrapped surface, Oslo, Circulating-magma evaporator – Freeze drying – Principle, process, applications – Case studies- Citric acid, Penicillin , Cephalosporin, Recombinant Streptokinase, Interferon.

REFERENCES

1. Belter, P.A., Gussler, E.L. and Hu, W.S., "Bioseparation: Downstream Processing for Biotechnology", John Wiley and Sons,2011.
2. Forciniti, D., "Industrial Bioseparation: Principles & Practice", Blackwell,2008.
3. Ghosh, R., "Principles of Bioseparations Engineering", World Scientific Publishers,2006.
4. Ladisch, M.R., "Bioseparations Engineering: Principles, Practice, and Economics", John Wiley & Sons,2001.
5. Roger, H., "Bioseparations Science and Engineering", Oxford University Press,2006.

MTBT-115 -ELECTIVE – I

MTBT -115-1: BIO-ANALYTICAL TECHNIQUES

Course Objectives :

The course is designed to impart the knowledge in analytical techniques in biotechnology. The various modern analytical techniques like UV-Visible, IR, NMR, Mass, GC, HPLC, different chromatographic methods and other important topics will be taught to enable the students to understand the principles involved in techniques. In addition to theoretical aspects, the basic practical knowledge relevant to the analysis will also be imparted.

- To have a fundamental knowledge about the Light spectrum, Absorption, NMR, Mass spectroscopy
- To acquire knowledge on the different chromatographic methods for separation of biological products.
- To Understand the methods to obtain pure proteins, enzymes and in general about product development R &D

Course Outcomes: On completion of the course, students will be able to

1. Understand spectroscopy and the separation techniques used for biological products.
2. Quantify Bio molecules using spectroscopy methods
3. Purify enzymes and metabolites using Chromatography techniques
4. Gain knowledge in various assay techniques for qualitative and quantitative estimation of biomolecules

SYLLUBUS

UNIT I

Chromatographic Techniques - Affinity - Adsorption - paper - Thin layer - Column - Ion Exchange - Gel Chromatography - Applications.

UNIT II

Gas liquid chromatography - High Pressure liquid chromatography - Equipment - Applications.

UNIT III

Spectrophotometric Techniques - IR - UV - Visible - NMR - ESR - Optical density - Circular dischroism.

UNIT IV

pH - pH titrations - Determination of pKa values - Buffers - Preparation - Buffer Action - Physiological buffers - potentiometric titration - centrifugal dialysis - lyophilization - Electrophoresis - Ultra filtration - Assay techniques for proteins, lipids, sugars, amino acids and nucleic acids.

Unit – V

Microscopic Techniques

Light Microscopy; Fluorescence microscopy,Atomic force microscope,Electron microscope,Scanning electron microscopy, Transmission Electron microsope.Application of microscope in analyzing biological samples.

Text Books:

1. "Instrumental methods of Chemical Analysis - Chatwal, G & Anand, S. Himalaya Publishing House, Bombay.
2. "Instrumental methods of Chemical Analysis - Sharma, B.K. Goel Publishing House, Meerut.
3. "Instrumental Methods Analysis - Willard, Merritt, Dean & Settle, CBS Publishers & Distributors, Delhi.

MTBT-115-2-BIOINFORMATICS

Course Objectives:

- To improve the programming skills of the student in the field of Biological research
- To let the students know the recent evolution in biological databank usage

Course Outcomes:

Upon completion of this course, students will be able to

1. Develop bioinformatics tools with programming skills.
2. Apply computational based solutions for biological perspectives.

SYLLABUS

UNIT I

Introduction, Molecular Biology and Bioinformatics, Biological database,
Primary, Secondary and Structural data bases, tools for web search, data retrieval tools

UNIT II

Genome analysis and gene mapping: sequence assembly problem, genetic mapping and linkage analysis, genome sequencing, sequence assembly tools, Human genome project. Alignment of pairs of sequences, scoring matrices, multiple sequences, phylogenetic analysis, Tree evaluation, automated tools for phylogenetic analysis, working with FASTA and BLAST.

UNIT III

Gene identification and prediction: Basis for gene prediction, pattern recognition, gene prediction methods, working with DNA, Micro arrays, Micro array analysis.

UNIT IV

Protein classification and structure visualization: structure – based protein classification, protein structure databases, visualization databases and tools, protein structure alignment, tools for plotting protein-ligand interaction.

Protein structure prediction: Analysis and prediction of primary structure and secondary structure, motifs, profiles, patterns and fingerprints search, Ab Initio approach, 2-D structure prediction, protein function prediction from DNA sequence.

UNIT V

Proteomics: Tools and techniques in proteomics, protein – protein interactions, gene family identification methods. Computational Methods for pathways and systems Biology: Analysis of pathways, metabolic network properties, metabolic control analysis, simulation of cellular activities.

Text-book:

S.C..Rastogi, N.Mendiratta and P.Rastogic, **Bioinformatics**, Prentice- Hall of India Pvt.Ltd, New Delhi, 2004

Reference books:

1. T.K.Attwood and D.J. Parry-Smith, Introduction to Bioinformatics, Pearson Education Asia, Delhi, 2002
2. A.M. Lesk, Introduction to Bioinformatics, Oxford University press, New Delhi, 2004.

MTBT-115-3: IPR AND BIOSAFETY

Course Objectives:

- To create awareness about IPR and engineering ethics
- To follow professional ethics and practices in their careers
- To create awareness and responsibilities about the environment and society

Course Outcomes:

Upon completion of this course, the student would be able

1. To understand the ethics and responsibility for safety
2. To create awareness for the professional responsibilities and rights

SYLLABUS

UNIT I

Agreements, Treaties And Concept Of PriorAct:

History of GATT Agreement – Madrid Agreement – Hague Agreement – WIPO Treaties – Budapest Treaty – PCT – Indian Patent Act 1970 & recent amendments Ordinary – PCT – Conventional – Divisional and Patent of Addition – Specifications – Provisional and complete – Forms and fees Invention in context of "prior art" – Patent databases – Searching International Databases – Country-wise patent searches (USPTO,esp@cenet(EPO) – PATENT Scope(WIPO), IPO,etc.

UNIT II

IPR:

Intellectual property rights – Origin of the patent regime – Early patents act & Indian pharmaceutical industry – Types of patents – Patent Requirements – Application preparation filing and prosecution – Patentable subject matter – Industrial design, Protection of GMO's IP as a factor in R&D,IP's of relevance to biotechnology and few casestudies.

UNIT III

Patent FilingProcedures:

National & PCT filing procedure – Time frame and cost – Status of the patent applications filed – Precautions while patenting – disclosure/non-disclosure – Financial assistance for patenting – Introduction to existing schemes Patent licensing and agreement Patent infringement – Meaning, scope, litigation, case studies.

UNIT IV

Biosafety:

Introduction – Historical Backround – Introduction to Biological Safety Cabinets – Primary Containment for Biohazards – Biosafety Levels – Biosafety Levels of Specific Microorganisms – Recommended Biosafety Levels for Infectious Agents and Infected Animals – Biosafety guidelines–Government of India.

UNIT V

Genetically Modified Organisms:

Definition of GMOs & LMOs – Roles of Institutional Biosafety Committee – RCGM – GEAC etc. for GMO applications in food and agriculture – Environmental release of GMOs – Risk Analysis – Risk Assessment – Risk management and communication – Overview of National Regulations and relevant International Agreements including Cartegana Protocol.

REFERENCES

1. Bouchoux, D.E., "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets for the Paralegal", 3rd Edition, Delmar Cengage Learning,2008.
2. Fleming, D.O. and Hunt, D.L., "Biological Safety: Principles and Practices", 4th Edition, American Society for Microbiology,2006.
3. Irish, V., "Intellectual Property Rights for Engineers", 2nd Edition, The Institution of Engineering and Technology,2005.
4. Mueller, M.J., "Patent Law", 3rd Edition, Wolters Kluwer Law & Business,2009.
5. Young, T., "Genetically Modified Organisms and Biosafety: A Background Paper for Decision-Makers and Others to Assist in Consideration of GMO Issues" 1st Edition, World Conservation Union,2004.

MTBT-116 -ELECTIVE – II

MTBT-116 -1: CANCER BIOLOGY

Course Objectives:

To enable the students to understand

- Basic biology of cancer
- Impact of antibodies against cancer in the human body leading to more effective treatments
- Enhanced immunology based detection methods and imaging techniques
- Development of cell based and cytokine based immunotherapy against cancer

Course Outcomes:

The course would facilitate the students

1. To appreciate the role of immune system in cancer
2. To understand the cancer microenvironment and its influence on immune cells
3. To medical applications of cytokines and immune cells against cancer.

SYLLABUS

UNIT I

Principles Of Cancer Biology:

Cancer: Definition, causes, properties, classification, clonal nature – Cell Cycle: Regulation of cell cycle, cell proliferation and apoptosis – Signal transduction pathways – Apoptosis: apoptotic pathways, signal molecules, effects on receptor, signal switches – Modulation of cell cycle in cancer – Mechanism of spread.

UNIT II

Principles Of Carcinogenesis:

Cancer risk factors – Theory of carcinogenesis – Chemical carcinogenesis – Physical carcinogenesis: x-ray radiation – mechanisms of radiation carcinogenesis – Stages of cancer: initiation, promotion, progression.

UNIT III

Molecular Biology Of Cancer:

Signal targets and cancer – Growth factors – Transformation – Activation of kinases – Oncogenes: c-Myc, Ras, Bcl-2 family – Mechanism of oncogene activation – Retroviruses and oncogenes – Detection of oncogenes – Oncogenes/proto oncogene activity – Tumor suppressor genes: Rb, p53, APC, BRCA paradigms –Telomerases.

UNIT IV

Cancer Metastasis:

Clinical significances of invasion – Heterogeneity of metastatic phenotype – Metastatic cascade: basement membrane disruption, invasion – Recent approach to identify key factors controlling metastasis – Angiogenesis.

UNIT V

Cancer Therapy:

Therapy forms – Surgery, chemotherapy, radiation therapy - Detection of cancers – Prediction of aggressiveness of cancer – Advances in cancer detection – Tumor markers; New approaches of cancer therapy – mAbs, vaccines, gene therapy, stem cell therapy.

REFERENCES

1. Fialho, A. and Chakrabarty, A., "Emerging Cancer Therapy: Microbial Approaches and Biotechnological Tools" 1st Edition, Wiley,2010.
2. Pelengaris, S. and Khan, M., "The Molecular Biology of Cancer", Blackwell Publishing, 2006.
3. Ruddon, R.W., "Cancer Biology", 2nd Edition, Oxford University Press,2007
4.Schulz, W.S., "Molecular Biology of Human Cancers – An Advanced Students Text Book", Springer,2005.
5. Weinberg, R.A., "The Biology of Cancer", Taylor & Francis, Garland Science,2007

MTBT-116-2:TISSUE ENGINEERING

Course Objectives:

To enable the students

- To learn the fundamentals of tissue engineering and tissue repairing
- To acquire knowledge on clinical applications of tissue engineering
- To understand the basic concept behind tissue engineering focusing on the stem cells, biomaterials and its applications

Course Outcomes:

Upon completion of this course, the students would get

1. Ability to understand the components of the tissue architecture
2. Opportunity to get familiarized with the stem cell characteristics and their relevance in medicine
3. Awareness about the properties and broad applications of biomaterials
4. Overall exposure to the role of tissue engineering and stem cell therapy in organogenesis

SYLLABUS

UNIT I

Fundamental of tissue engineering:

Cell cycle – Stem cells – Types, factors influencing stem cells – Mechanical properties of cells and tissues, cell adhesion – Extracellular matrix – Glycans, laminin, fibronectin, collagen, elastin, extracellular matrix functions – Signalling – Mechanics and receptors – Ligand diffusion and binding, trafficking and signal transduction – *In vitro* cell proliferation.

UNIT II

Biomaterials For Tissue Engineering:

Measurement of protein adsorption – Direct and indirect methods, fibrinogen adsorption – Displaceable and non-displaceable – Changes in protein conformation upon adsorption – Vroman effect principle to maximize the amount of fibrinogen adsorption – Devices for tissue engineering transplant cells.

UNIT III

Delivery of molecular agents and cell interactions with polymers:

Molecular agents in tissue engineering – Controlled released of agents – Methods, in time and space – Future applications of controlled delivery – Microfluidic systems – Microfluidics and microfluidic devices – Cell interactions – Factors influencing cell interactions – Cell interactions with polymer surfaces and suspension – Cell interactions with three-dimensional polymer.

UNIT IV

Polymers And Controlled Drug Delivery:

Natural and synthetic biodegradable Polymers – Engineered tissues – Skin regeneration – Nerve regeneration – Liver, cartilage, bone – Biodegradable polymers in drug delivery – Polymeric drug delivery systems – Applications of biodegradable polymers.

UNIT V

Biopolymer- based biomaterials as scaffolds and stem Cells:

Natural polymers – Structural and chemical properties, scaffold processing, mechanical properties and biodegradability – Biocompatibility and host response – Application of scaffolds in tissue engineering. Use of stem cells in tissue engineering – Embryonic stem cells, mesenchymal stem cells (MSC), adult stem cells, markers for detection of stem cells – Risks with the use of stem cells.

REFERENCES

1. Pallua, N. and Suscheck, C.V., "Tissue Engineering: From Lab to Clinic" Springer,2010
2. Palsson, B., Hubbell, J.A., Plonsey, R. and Bronzino, J.D., "Tissue Engineering", CRC Press, 2003.
3. Palsson, B.O. and Bhatia, S., "Tissue Engineering", Pearson Prentice Hall,2004.
4. Saltzman, W.M., "Tissue Engineering", Oxford University Press,2004.
5. Scheper, T., Lee, K. and Kaplan, D., "Advances in Biochemical Engineering / Biotechnology – Tissue Engineering I", Volume 102, Springer-Verlag Berlin Heidelberg,2006.

MTBT116-3: ANIMAL BIOTECHNOLOGY

Course Objectives:

- To provide the fundamentals of animal cell culture, diseases and therapy
- To offer the knowledge about the micromanipulation and transgenic animals

Course Outcomes:

Upon completion of this subject the student will be able to

1. Understand the animal cell culture, animal diseases and itsdiagnosis
2. Gain the knowledge for therapy of animal infections
3. Know the concepts of micromanipulation technology and transgenic animal technology
4. Use the knowledge gained in this section to apply in the field of clinical research

SYLLABUS

UNIT I

Cell Culture

Culturing of cells– Primary and secondary cell lines – Genetics of cultured cells – Scaling up in suspension –Monolayer culture – Bio-reactors used for animal cell culture –Roller bottle culture– Bioreactor process control –Stirred animal cell culture –Air-lift fermentor, Chemostat/Turbidostat– Cell lines and their applications.

UNIT II

Gene Cloning Vectors And Immunology:

Viral disease in animals–Animal viral vectors –Vector design–SV40, adeno virus, retrovirus, vaccinia virus, herpes virus, adeno associated virus and baculo virus– Immune response – Lymphocyts, immune system – Baculo virus expression vectors–Vaccines and their applications in animal infections –High technology vaccines – Hybridoma technology.and production of monoclonal antibodies.

UNIT III

Stem Cell And Cloning:

Characteristics of ES cells –Types of stem Cells – ES cell research–*In vitro* derivation of gametes

–Maintenance of stem cells in culture and applications – Somatic cell nuclear transfer – Gene expression of pluripotent cells –Cellular reprogramming –Induced pluripotency– Cloning techniques in animals and therapeutic cloning.

UNIT IV

Genetic Engineering:

Gene therapy –Prospects and problems – Single gene – Gene mapping – Hematopoietic cells for cellular gene therapy of animal disease –Knockout mice and mice model for human genetic disorder –Baculo virus in biocontrol– Enzymes technology – Somatic manipulation of DNA – Nucleic acid hybridization and probes in diagnosis– Preparation of probes, evaluation and applications.

UNIT V

Applications:

Rumen manipulation– Probiotics embryo transfer technology – *Invitro* fertilization, transgenesis– Methods of transferring genes into animal oocytes, eggs, embryos and specific tissues by physical, chemical and biological methods–Biopharming– Transgenic animal technology, application to production and therapeutics (mice, sheep, cattle) – Artificial insemination and embryo transfer – Transgenic growth hormonegenes.

REFERENCES

1. Freshney R.I. Cultures of Animal cells: A manual of Basic Techniques and specialized applications, 6th Edition, John Wiley and Sons,2010.
2. Glick, B.R. and Pasternack, J.J. and Pattern ,C. Molecular Biotechnology, 4th Edition ASM Press,2003
3. Lewin, B. Genes VIII , Pearson Prentice Hall,2004
4. Portner, R, Animal Cell Biotechnology, Methods and Protocol, 2nd Edition, Humana Press, 2007

MTBT-117 : Biotechnology Lab-1

Course Objectives:

- To Provide hands on experience on production and down streaming through simple experiments

Course Outcomes:

1. Gain ability to design and conduct experiments, analyse, interpret and apply laboratory skills to solve bioprocess engineering problems.
2. Skills and knowledge gained is useful for bio industry and research

List of Experiments:

1. Preparation of Acetate buffer system and validation of Hendersen-Hesselbalch Equation
2. Determination of Absorption spectrumof BSA using UV- Visible Spectrophotometer and validation of Beer-Lamberts Law
3. A. Separation of Aminoacids and Selection of solvents by Thin Layer Chromatography.

   B. Titration of Aliphatic and Aromatic aminoacids.
4. Determination of Growth curve for *Bacillus cereus* in Nutrient Broth
5. Screening of two substrates for *Bacillus cereus* for amylase production by submerged cultivation
6. Optimization of Amylase production medium for Bacillus cereus using Barley starch as substrate by Response surface Methodology
7. Partial purification of Proteins by Salt precipitation
8. Desalting of Protein sample by Dialysis
9. Enzyme purification by Ion-Exchange Chromatography
10. Adsorption of Methylene Blue on to activated carbon and Evaluation of Langmuir and Fruendlich Isotherms
11. Extraction of Ethanol obtained by submerged fermentation using distillation principle
12. Protein purification by Affinity chromatography
13. Effect of pH on the production of antibiotic (Streptomycin) using *Streptomyces griseus*

II SEMESTER

MTBT-121: GENETIC ENGINEERING

Course Objectives:

To make the student to understand

- the basic tools in genetic engineering
- Cloning and expression vectors
- Preparation of genomic and cDNA libraries
- Production and downstream processing of recombinant proteins

Course Outcomes:

1. The students after completing this course would be aware of clone methods of commercially important genes.
2. The students would be aware of producing the commercially important recombinant proteins.
3. The students would be aware of gene and genome sequencing techniques.
4. The students would be aware of applications of gene cloning in medicine, agriculture and environment.

SYLLABUS

UNIT I

Cloning vectors:
Ideal features of cloning vectors – plasmids and bacteriophages – cloning vectors for *E.coli* ; pBR322, pUC vectors, M13 and other plasmid vectors – Cosmids, Phagemids – vectors for Bacillus, Streptomyces Restriction mapping and analysis

UNIT II

Enzymes And Techniques for cloning:
DNA modifying enzymes – ligases – Nucleic acid probe preparation; Radioactive and nonradioactive labels – Hybridization techniques – PCR; different types and applications – DNA sequencing – DNA fingerprinting – RFLP, RAPD – chromosome walking.

UNIT III

Expression vectors:
Expression vectors in prokaryotes – Expression vectors in Eukaryotes-Yeast cloning

vectors – selectable markers for eukaryotes – SV40, Papilloma, Retrovirus, Baculoviral vectors – mammalian cell expression system – Gene transfer techniques – Agrobacterial plasmids – Ti plasmid and viral vectors – cloning in plants.

UNIT IV

Genomic And cDNA library:
Different strategies for in vitro and in vivo cloning – Preparation of rDNA, Preparation of cDNA and genomic DNA libraries – screening procedures – linkers, adapters, homopolymer tailing and TA cloning – gene transfer technologies – Mutagenesis – site directed mutagenesis – application.

UNIT V

Application Of gene cloning:

Fusion protein- down-stream processing of recombinant proteins- Applications in medicine – Gene therapy- Diagnostics, pathogenesis, recombinant vaccines –humanized antibodies and their applications genetically modified food – bioremediation with recombinant micro organisms– forensic science – genetic diversity – Agriculture, crop improvement – production of biosensors, enzymes – safety guidelines in rDNA research – containment and disposal.

Text Books:

1. Introductory Bio - Technology by R. P. Singh.
2. Principles of genetic Engineering by Old and Primarose.

REFERENCES:

1. Jeremy W. Dale, Malcolm von Schantz, Nicholas Plant. From Genes to Genomes: Concepts and Applications of DNA Technology-3rd Edition. 2011.Wiley-Blackwell.
2. Michael R. Green and Joseph Sambrook. Molecular Cloning: A Laboratory Manual (Fourth Edition). 2012. Cold Spring HarborPress.
3. Jocelyn E. Krebs, Elliott S. Goldstein and Stephen T. Kilpatrick. Lewin's GENES XI. 2012. Jones & BartlettLearning.
4. Sandy B. Primrose and Richard Twyman. Principles of Gene Manipulation and Genomics. 2009.Wiley.
5. T. A. Brown. Gene Cloning and DNA Analysis: An Introduction, 6th Edition. 2010.Blackwell.

MTBT -122: ENZYME ENGINEERING

Course Objectives:

1. To understand the importance of enzymes, their classification, sources, extraction and purification of enzymes.
2. To understand the mechanism of enzyme action, their kinetics and types of enzyme inhibitions.
3. To know about the advantages of immobilization of enzymes, methods of immobilization.
4. To acquaint with the applications of enzymes in solution as well as immobilized enzymes.

Course Outcome:

1. The student is able to appreciate the importance of enzymes and know about their sources and extraction.
2. The student can analyze the kinetics of enzyme reactions, and can identify the type of enzyme inhibition.
3. The student will know to use different immobilization techniques and enzyme purification.
4. The student will be aware of different enzymes and their applications used in various industries.

SYLLABUS

UNIT I

Introduction To Enzymes: Importance of enzymes in Biotechnology, Nomenclature and classification of enzymes, enzyme specificity, coenzymes, enzyme units and turnover number, factors affecting enzyme activity (pH, temperature, chemical agents and irradiation), mechanism of enzyme catalysis.

UNIT II

Enzyme Kinetics: Simple enzyme kinetics, Michaelis-Menten equation, Quasi-steady-state kinetics and Briggs –Haldane approach, Evaluation of parameters in Michaelis-Menten equation.

Enzyme Inhibition: Inhibition of enzyme reactions-Competitive, non-competitive, uncompetitive, substrate and product inhibition, deactivation kinetics, derivations of M-M form of equations for various inhibitions.

UNIT III

Sources Of Enzymes: Plant, animal and microbial sources and their advantages and disadvantages.

Enzyme Extraction And Purification: Methods of production of enzymes, cell disruption, extraction of enzymes, purification of enzymes.

UNIT IV

Enzyme Immobilization: Methods of immobilization- physical and chemical (covalent binding, cross-linking, adsorption, matrix entrapment and microencapsulation), advantages and disadvantages of different immobilization techniques, kinetics of immobilized enzymes, mass transfer effects in immobilized enzyme systems.

UNIT V

Enzyme Applications: Application of enzymes in various industries (brewing, detergent, starch, baking, dairy, food, leather, wool, animal feed, textile, paper and pulp, pharmaceutical).

Application Of Immobilised Enzymes: Immobilized enzyme processes, HFCS, production of amino acids, antibiotics.

Text books:

1. Enzyme Technology by Chaplin, M.F and Bucke, C Cambridge University Press,1990.
2. Enzyme Technology 2nd Ed S.Shanmugan, T.Sathish Kumar, M.Shanuga Prakash I.K.International Publishing House Pvt. Ltd.
3. Biochemical Engineering Fundamentals. J.E.Bailey and David F Ollis 2nd Edition 1986, McGraw Hill.

References books:

1. Enzyme Engineering. L.B.Wingard, J.Inter Science, New York 1972.
2. Enzymes Trevor Palmer East West Press Pvt. Ltd. New Delhi

MTBT-123: ENVIRONMENTALBIOTECHNOLOGY

Course Objectives:

The proposed course is designed

- To understand the scientific and engineering principles of microbiological treatment technologies to clean up contaminated environments
- To replace of conventional treatment methodologies by molecular biology and genetic engineering strategies
- To seek the way for the alternate sources of energy to avoid environmental issues

Course Outcomes:

Upon successful completion of the course

1. Environmental Pollution or problems can be solved
2. Scientific solutions and participation can be served for the environmental Protection
3. improvement for the alternate sources of energy to avoid environmental disasters

SYLLABUS

UNIT I

Biodegradation And Bioremediation:

Aerobic and Anaerobic degradation of aliphatic and aromatic compounds – Biodegradation of herbicides and pesticides. Bioremediation technologies – Biostimulation, Bioaugmentation, Bioventing, biosparging and Phytoremediation – Bioleaching, bioprecipitation, bioaccumulation and biosorption of heavy metals.

UNIT II

Microbial Metabolism In wastewater treatment:

Decomposition of organic compounds in natural ecosystems – Co-metabolic degradation of organo-pollutants - Hydrolysis of biopolymers by aerobic and anaerobic microorganisms – Anaerobic degradation of carbohydrates, proteins, lipids – Nitrogen removal – Ammonification, nitrification, denitrification

UNIT III

Biological Treatment of Wastewater:

Physico-chemical characteristics of wastewater – Overview of aerobic and anaerobic treatment processes – Process design of aerobic and anaerobic system – Activated sludge process – Trickling filter – Rotating biological contactors – Fluidized bed reactor – Up flow anaerobic sludge blanket reactor (UASB) – Membrane bioreactors – Algal photosynthesis in wastewater treatment.

UNIT IV

Biotechnology For Air Pollution And waste management:
Air pollution control and treatment strategies – Biotechnology for treating air pollutants – Biofilters and Bioscrubbers – Biotechnology for the management of agricultural, plastic, dairy, paper and pulp, textile, leather, hospital and pharmaceutical industrial wastes.

UNIT V

Bioproducts From renewable sources
Overview of renewable sources – Production of biocompost and vermicompost – Production of biofertilizers and biopesticides – Production of biomethane, bioethanol, biohydrogen, biodiesel – Production of bioplastics and biopolymers – Bioelectricity generation and value added products from renewable sources.

TEXT BOOKS:

1. Environmental Pollution Control Engineering by C. S. Rao. Wiley Eastern Limited
2. Waste Water Treatment: Rational Methods of design and industrial practices by M. Narayana Rao and Amal K. Datta. Oxford & IBH publishing Co. Pvt. Ltd.
3. Environmental Biotechnology: Basic concepts and applications by Indu Shekhar Thakur. 1. K. International Pvt. Ltd.

References:

1. Chakrabarty K.D., Omen G.S., Biotechnology And Biodegradation, Advances In Applied Biotechnology Series , Vol.1, Gulf Publications Co., London,1989.
2. Evans, G.G. and Furlong, J., Environmental Biotechnology: Theory and Application, 2nd Edition, John Wiley & Sons,2011.
3. Henze, M., Harremoes, P., Jansen, J.C. and Arvin, E., “Wastewater Treatment: Biological and Chemical Processes”, 2nd Edition, Springer,2013.
4. Jordening, H.J. and Winter, J., “Environmental Biotechnology: Concepts and Application”, Wiley-VCH Verlag GmbH & Co.,2005.
5. Wong J.W-C., Tyagi R.D., and Pandey. A., “Current Developments in Biotechnology and Bioengineering Solid waste” Elsevier,2016.
6. Zarook, S. and Ajay,S., Biotechnology for Odor and Air Pollution Control, Springer,2005.

MTBT-124: Bio Nanotechnology

Course Objectives:

To enable the students

- To learn about basis of nanomaterial science, preparation method, types and application

Course Outcomes:

Upon completing this course, the students

1. Will familiarize about the science of nanomaterials
2. Will demonstrate the preparation of nanomaterials
3. Awareness about the properties and broad applications of biomaterials

SYLLABUS

UNIT I

Nanoscale Processes and nanomaterials:

Overview of nanoscale processes and characterization of nanomaterials – Physicochemical properties of nanomaterials – Concepts in nanotechnology – Natural nanomaterials –Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Polymeric nanoparticles, Buckyballs, Nanotubes) – Interaction between biomolecules and nanoparticle surface –Synthesis and assembly of nanoparticles and nanostructures using bio-derived templates.

UNIT II

Structural And Functional Principles Of Bionanotechnology:

Biomolecular structure and stability – Protein folding – Self-assembly – Self-organization – Molecular recognition – Flexibility – Information-Driven nanoassembly – Energetics – Chemical transformation – Regulation – Biomaterials – Biomolecular motors – Traffic across membranes – Biomolecular sensing – Self-replication – Machine-phase bionanotechnology.

UNIT III

Protein-Based Nanotechnology:

Overview of protein nanotechnology – Nanotechnology with S-Layer protein – Engineered nanopores – Bacteriorhodopsin and its potential – Protein assisted synthesis of metal nanoparticles – Synthesis of protein-based nanoparticles – Protein nanopaticle-hybrids – Covalent and non-covalent protein nanoparticle conjugates – Protein-carbon nanotubeconjugates.

UNIT IV

DNA-Based nanotechnology:

DNA-based nanostructures – Biomimetic fabrication of DNA based metallic nanowires and networks – Self assembling DNA structures – DNA-nanoparticle conjugates – DNA-carbon nanotube conjugates – DNA templated electronics – DNA nanostructures for mechanics and computing – DNA nanomachine.

UNIT V

Nanomedicine and nanosensing:

Promising nano biotechnologies for applications in medicine – Role of nanotechnology in methods of treatment – Liposomes in nanomedicine – Therapeutic applications of nanomedicine – Nano- Sized carriers for drug delivery and drug carrier systems – Protein and peptide nanoparticles, DNA based nanoparticles, Lipid matrix nanoparticles for drug delivery – Design and development of bio nanosensors using DNA, enzymes – Nano biosensors for imaging and diagnosis.

REFERENCES:

1. Gazit, E., and Mitraki, A., "Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology", Imperial College Press, 2013.
2. Goodsell, D.S., "Bionanotechnology", John Wiley and Sons,2004.
3. Jesus M. de la Fuente and Grazu, V., "Nanobiotechnology: Inorganic Nanoparticles Vs Organic Nanoparticles" Elsevier,2012.
4. Niemeyer, C.M. and Mirkin, C.A., "Nanobiotechnology: Concepts, Applications and Perspectives", Wiley- VCH,2006.
5. Shoseyov, O. and Levy I., "Nanobiotechnology: Bioinspired Devices and Materials of the Future", Humana Press,2008.

MTBT-125: ELECTIVE-III

MTBT- 125-1: Industrial Biotech Products

Course Objectives:

- To study the structure and functions of various fermentors and study indetail the production media preparation, inoculums preparation and sterilization methods.
- To study the production ethyl alcohol, vinegar, lactic acid , citric acid and amino acids using microbial fermentation processes.
- To study the production of alcoholic and non alcoholic beverages in detail and to study the production of antibiotics, vitamins and baker's yeast, microbial enzymes and co-enzymes in detail using modern fermentation techniques.

Course Outcome:

1. Students will obtain vast knowledge in the fermentation technology to produce various industrially important bio products.
2. Students will acquire knowledge in handling bioreactors and sterilization methods.
3. Students can start small scale industries to produce bio products using fermentation techniques.
4. As this subject gives advanced level knowledge in the production of industrial biotech products, the further improvement and advances can be achieved by research.

SYLLABUS

UNIT I

Fundamentals involved in the' production of industrial Microbial products such as details of the Fermentors, Synthetic and natural medium, processors, Sterilization methods, and innocuium preparation. A detailed study of 'Ethanol' production by fermentation, using black blinap molasses, aarchy substance and glus\cosic like waste sulphate liquid purification methods of the fermented broth and production, of absolute ethyl alcohol.

UNIT II

Materials for fermentative production of Vinegar, Lactic Acid, Citric Acid, and Amino acids. The method Involves selection of the particular strain of the micro-organism for Industrial Fermentation, process details and purification.

UNIT III

Production of Alcoholic beverages with Beer, Brandy, Whisky and Wine. Baked goods, cheese and other dairy products.

UNIT IV

Production *of* Antibiotics, Tetracyclines, Alkaloids Bakers yeast and Microbial Enzymes and Co-enzymes.

UNIT V

Fermentative materials for producing vitamins, Products from plant cell Cultures, Non -

alcoholic beverages (Coco, Coffee, Tea fermentation).

Textbook:

"Industrial Microbiology" by Samuel C. Presscott and Cecil, G. Dunn; A McGraw - Hill Publication.

References:

1. "Industrial Mic~obiology" by L.E. Casida. Jr. Wiley Eastern Limited. , .
2. "Microbial Technology Vol. 1 and Vol. 2 by H.J. Peppler and D. Pulman (Academic Press).

MTBT- 125-2: Pharmaceutical Biotechnology

Course Objectives:

- To understand the required parameters for lead molecule identification and optimization
- To introduce various analytical tools employed in industrial sector during preclinical trials.
- To highlight the various drug delivery systems and production of biologicals in pharmaceutical market.

Course outcomes: At the end of the course **s**tudent is able to

1. Understand drug metabolism
2. Gain knowledge in Drug design and drug delivery systems
3. Summarize biologically derived therapeutic products .

UNIT I

Drug metabolism:
Biotransformation of drugs – Microsomal and non-microsomal mechanisms and the enzymes involved. Mode of excretion – Biliary/ fecal excretion, Factors affecting drug metabolism. Drug metabolism in fetus and new born. Models to study drug metabolism, Dose effect relationships, Adverse drug reactions – Toxic reactions, Allergic reactions, Idiosyncrasy, Acute poisoning and treatment.

UNIT II

QSAR AND drug design:
Drug Action – physicochemical properties and stereochemistry of compound. Isosterism and bioisosterism – metabolite, antagonist and structural variations. Methods for variation – Fibonacci search, Topliss tree, Craigsplot, Simplex methods, and Cluster analysis. Hansch's Liner method, Free and Wilson methods, mixed approached principal component analysis.

UNIT III

Computer assisted Combinatorial design:
Combinatorial chemistry – Introduction, Principles, methodology, purification and analytical tools in solid phase synthesis with case studies. Compound library, interactive graphics program – with examples.

UNIT IV

New Drug Regulation and DDs:

Rational drug design – phases of preclinical and clinical trials. Role of regulatory authorities., Drug delivery system – Basic concepts and Novel advances. Cell specific drug delivery, Brain specific drug targeting strategies and Pulmonary delivery systems.

UNIT V

Biological Products:
Properties of biotechnology derived therapeutic products. Production of Human insulin, Interferons, somatotropin, human growth hormone, somatostatin. Gene Therapy, vaccines, Monoclonal Antibody Based Pharmaceuticals, Recombinant Human Deoxyribonuclease

REFERENCES

1. K. D. Tripathi, "*Essentials of Medical Pharmacology*," 6th Edition, Jaypee publications,2008.
2. Gary Walsh, "*Pharmaceutical Biotechnology-Concepts and Applications*," Wiley,2007.
3. D. J. A. Crommelin, Robert D. Sindela, "*Pharmaceutical Biotechnology*," - 2nd Edition -2004.
4. Remington, "*The science and Practice of Pharmacy*," Vol. I and II, 20th Edition,2007.
5. Medicinal chemistry: A molecular and biochemical approach, 3rd Edition, OUP,2005.
6. Alfred Burger, "*Guide to Chemical Basis of Drug Design*," by (John Wiley & Sons)1983.
7. John Smith &Hywel Williams, "*Introduction to the Principles of Drug Design*,"Wright PSG,1983.

MTBT- 125-3: Agriculture Biotechnology

Course Objectives

:

- To give the details of conventional methods of breeding for crop improvement
- To understand about plant tissue culture and its applications
- To provide the basics of agro bacterium and methods of transformation in plants
- To familiarize commercial applications of genetic engineering in plants and also about biofertilizers

Course outcomes: At the end of the course **s**tudent is able to

1. Understand methods of breeding of various crops for improvement
2. Learn about micropropagation, somatic hybridization , synthetic seed and can use gained knowledge for entrepreneurship
3. Summarize applications of genetic engineering in agriculture
4. Understand the ethics and responsibility for safety.

UNIT 1

Introduction to Agricultural biotechnology :

Conventional methods of crop improvement, Objectives of plant breeding, Types of breeding, Genetic variation and manipulation of variability, Breeding of selected crops- important cereals, pulses, oilseeds, fibre, sugar and cash crops, Classical deliberate interbreeding, Intraspecific hybridization, Methods of breeding of self-pollinated crops and cross- pollinated crops, Methods of breeding asexually propagated crops, self incompatibility and male sterility in crop breeding, mutation breeding, Ploidy breeding, Innovative breeding methods, Hybrid varieties

UNIT 2

Plant tissue culture and its application:

Principles of plant micropropagation, The totipotency concept, Role & composition of Plant tissue culture media, Micropropagation pathways, Callus induction & culture, organogenesis and embryogenesis, Meristem tip culture, Haploid production, Hardening of plants, Techniques of anther, embryo and ovule culture, Protoplast isolation, Somatic hybridization, Cybrids, Somaclones, Artificial seed Technology(synthetic seed), Embryo rescue, Production of secondary metabolites, Cryopreservation and germplasm storage

UNIT 3

Plant molecular biology:

Organelle DNA, Regulation of gene expression, Methods of gene transfer in plants, Achievements and recent developments of genetic engineering in agriculture, Development of transgenies for biotic & abiotic stress tolerance, Ribozfore Technology, Ti plasmid-based transformation, Agrobacterium biology, crown gall and hairy root disease, Ti and Ri plasmids, T-DNA genes, borders, overdrive, chromosomal and Ti plasmid virulence genes and their functions, vir gene induction, mechanism of T-DNA transfer, Ti pasmid vectors, vir helper plasmid, super virulence and monocot transformation, binary vector, Transgene silencing, Strategies to avoid transgene silencing, Direct transformation of protoplasts using PEG, electroporation, Transformation by particle bombardment, Assembly of particle gun, Microprojectile preparation and bombardment, Chloroplast transformation by particle bombardment.

UNIT 4

Advanced technology for crop improvement:

Genetic engineering of crops, Commercial status of transgenic plants, Herbicide resistance, glyphosate, sulfonyl urea, phosphinothricin, atrazine, Pest resistance, B.t. toxin, synthetic B.t. toxin, Bt brinjal, Bt cotton, Protease inhibitor, GNA and other lectins, α-amylase inhibitor, nematode resistance, Genetic engineering for male sterility-Barnase-Barstar, Delay of fruit ripening, polygalacturanase, ACC synthase, ACC oxidase, Improved seed storage proteins, Improving and altering the composition of starch and plant oils, Golden rice for β-carotene accumulation, Production of antibodies and pharmaceuticals in plants, Biofertilizers,

UNIT5

Ethics and Biosafety:

Ethical issues in biotechnology, Biosafety and Risk assessment of GMOs, Public perception. IPR and Trade related aspects, Methods for producing transgenic plants, Important genes of agronomic interest, Current trends in finding useful genes, GMO Act 2004. Traceability, Legislative aspects.Introduction, Historical Backround, Introduction to Biological Safety Cabinets, Primary Containment for Biohazards, Biosafety Levels, Biosafety Levels of Specific Microorganisms, Recommended Biosafety Levels for Infectious Agents and Infected Animals, Biosafety guidelines - Government of India, Definition of GMOs & LMOs, Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture, Environmental release of GMOs, Risk Analysis, Risk Assessment, Risk management and communication, Overview of National Regulations and relevant International Agreements including Cartegana Protocol

Text books

1.Keshavachandran.R and K V Peter. 2008 .Plant Biotechnology: Tissue culture and Genetransfer. Orient and Longman, (Universal Press) Chennai.

2.Gresshoff, Peter M. (Ed). Plant biotechnology and development. 1992.

3.Jones, MGK & Lindsey, K. "Plant Biotechnology" in Molecular biology and biotechnology, Walker, JM & Gingold, EB (Eds). 2000.

4.Kumar H D, Agricultural Biotechnology, India ,2005

Reference books:

1.Esau's Plant Anatomy, Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function, and Development, 3rd Edition, John Wiley & Sons, 2006.

2.R.H.Smith, Plant Tissue Culture: Techniques and Experiments, Academic Press, San Diego. 1992.

3.M. J. Chrispeels and D.F. Sadava (eds), Plants, Genes and Crop Biotechnology, 2nd Edition, Jones and Barlett Press, 2003

4.J.H. Hammond, P. Mcgarvey, and V. Yusibov (eds), Plant Biotechnology, Springer Verlag, Heidelberg. 2000

5.BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007

6.Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd., 2007

7.Encyclopedia of ethics, legal and policy issues in biotechnology. 2000

MTBT-126 – ELECTIVE - IV

MTBT-126-1: BIOTECHNOLOGY IN FOOD PROCESSING

Course Objectives:

To enable the students

- To know about the constituents and additives present in the food.
- To gain knowledge about the microorganisms, food spoilage diseases.
- To know different techniques used for the preservation of foods.

Course outcomes:

Through this subject the student can understand about

1. Different constituents present in food and microorganism involved in processing of food.
2. Principles and different preservations techniques of food.
3. Unit operations in modern food processing and impact of the process on food quality

SYLLABUS

UNIT I

Food Processing:

Heat Processing using steam or water (Blanching, Pasteurization) – Heat sterilization (Evaporation and distillation) – Heat processing using hot air (Dehydration, baking and roasting) – Heat processing using hot oils – Processing by the removal of heat (chilling , Freezing) – High pressure processing of foods – Pulsed electric field processing of liquids and beverages – Non-thermal processing by radiofrequency electric fields.

UNIT II

Food Fermentation:

Fermentative production of foods – Single cell protein (yeast, mushroom) – Microorganisms responsible for production of fermented foods – Enzyme in bakery and cereal products – Enzymes in fat/oil industries – Protease in cheese making and beverage production – Production of Pectinases and Utilization in Food Processing – Food Flavour Production – Utilization of food waste for production of valuables.

UNIT III

Fermented Foods:

Overview of fermented foods – Bean-based – Grain-based – Vegetable-based – Fruit-based – Honey-based – Dairy-based – Fish-based – Meat-based – Tea-based – Advantages of fermented foods Health benefits of fermented foods – Nutritive value of fermented food – Biotechnological approaches to improve nutritional quality – Microbial changes in fermented food.

UNIT IV

Food Preservation techniques:

Spoilage of food - Microbiology of water, meat, milk, vegetables – Food poisoning – Cold preservation – Heat conservation – Ionizing radiation – High pressure – Electric field – Chemical food preservation – Combination of techniques for food preservation – Natural antioxidants – Antimicrobial enzymes – Edible coatings – Control of pH and water activity.

UNIT V

Food Quality and Control:

Analysis of food – Major ingredients present in different product – Food additives, vitamins – Analysis of heavy metal, fungal toxins, pesticide and herbicide contamination in food – Microbial safety of food products – Chemical safety of food products – Good manufacturing practice

REFERENCES

1. Adams M., Adams M. R. and Robert NoutM. J., “Fermentation and food safety”, Springer, 2001.
2. Da-Wen S., “Emerging Technologies for Food Processing”, Academic Press,2005.
3. Fellows, P.J., “Food Processing Technology: Principles and Practice”, 3rd Edition, CRC Press,2009.
4. HutkinsR. W., “Microbiology and Technology of Fermented Foods”, IFT Press series, Volume 32 of Institute of Food Technologists Series, Wiley-Blackwell,2006.
5. Pometto A, Shetty K, Paliyath G and Levin R. E., “Food Biotechnology”, 2nd Edition , CRC press,2005.
6. Zeuthen P. and Bogh-Sorensen, L., “Food Preservation Techniques”, 1st Edition, CRC Press,2003.

MTBT-126-2: BIOFUELS AND PLATFORM CHEMICALS

Course Objectives:

- To impart the knowledge Bioconversion of renewable lignocelluloses biomass to bio fuel and value added products
- To demonstrate a drive towards products benign to natural environment increasing the importance of renewable materials
- To emphasize the development of Biomass an inexpensive feedstock considered sustainable and renewable to replace a wide diversity of fossil based products

Course Outcomes:

On completion of the course, students will have gained knowledge on

1. The use of Biomass an inexpensive feedstock as sustainable and renewable energy
2. To replace fossil based products with Biodiesel
3. To source other alternate energy such as bio hydrogen and biorefinery

SYLLABUS

UNIT I

Introduction:

Cellulosic Biomass availability and its contents. Lignocellulose as a chemical resource. Physical and chemical pretreatment of lignocellulosic biomass. Cellulases and lignin degrading enzymes.

UNIT II

Ethanol:

Ethanol as transportation fuel and additive; bioethanol production from carbohydrates; engineering strains for ethanol production from variety of carbon sources to improved productivity.

UNIT III

Biodiesel:

Chemistry and Production Processes; Vegetable oils and chemically processed biofuels; Biodiesel composition and production processes; Biodiesel economics; Energetics of biodiesel production and effects on greenhouse gas emissions Issues of ecotoxicity and sustainability with ; expanding biodiesel production

UNIT IV

Other Biofuels

Biodiesel from microalgae and microbes; biohydrogen production; biorefinery concepts

UNIT V

Platform chemicals:

Case studies on production of C3 to C6 chemicals such as Hydroxy propionic acid, 1,3 propanediol, propionic acid, succinic acid, glucaric acid, cis-cis muconic acid.

Reference:

1. Lee, Sunggyu; Shah, Y.T. “Biofuels and Bioenergy”. CRC / Taylor & Francis, 2013 BY5020

MTBT-126-3: BIOPROCESS MODELING AND SIMULATION

Course Objectives:

- To make the students aware of the overall industrial bioprocess so as to help them to manipulate the process to the requirement of the industrial needs.
- To impart knowledge on design and operation of fermentation processes with all its prerequisites.
- Provide the students with the basics of bioreactor engineering.
- To develop bioengineering skills for the production of biochemical product using integrated biochemical processes.

Course Outcomes:

Upon completion of Bioprocess Engineering course graduates will be able to
1. Select appropriate bioreactor configurations and operation modes based upon the nature of bio products and cell lines and other process criteria.
2. Apply modelling and simulation of bioprocesses so as to reduce costs and to enhance the quality of products and systems.
3. Plan a research career or to work in the biotechnology industry with strong foundation about bioreactor design and scale-up.
4. Integrate research lab and Industry; identify problems and seek practical solutions for large scale implementation of Biotechnology.

SYALLBUS

UNIT I

Concepts and Principles:

Introduction to modelling–Systematic approach to model building–Material and energybalance –Classification of models – General form of dynamic models dimensionless models – General form of linear systems of equations nonlinear function – Conservation principles thermodynamic principles of process systems

UNIT II

Models:

Structured kinetic models – Compartmental models (two and three) – Product formation Unstructured models – Genetically structured models – Stochastic model for thermal sterilization of the medium – Modelling for activated sludge process – Model for anaerobic digestion – Models for lactic fermentation and antibiotic production

UNIT III

Modelling of Bioreactors:

Modelling of non-ideal behaviour in Bioreactors – Tanks-in-series and Dispersion models – Modelling of PFR and other first order processes – Analysis of packed bed and membrane bioreactors Recombinant Cell Culture Processes – Plasmid stability in recombinant Cell Culture limits to over-expression

UNIT IV

Monitoring of Bioprocesses:

On-line data analysis for measurement of important physico-chemical and biochemical parameters – State and parameter estimation techniques for biochemical processes – Biochemical reactors- model equations – Steady-state function – Dynamic behavior – Linearization – Phase plane analysis – Multiple steady state – Bifurcation behavior

UNIT V

Solution strategies:

Solution strategies for lumped parameter models – Stiff differential equations – Solution methods for initial value and boundary value problems – Euler's method – R-K method – shooting method – Finite difference methods – Solving the problems using MATLAB/SCILAB – ISIM-Simulation of bioprocesses using models from literature sources

References:

1. Bailey, J.A. and Ollis, D. F., Fundamentals of Biochemical Engineering", McGraw Hill – 1986.
2. Bequette, B.W., "Process Control: Modeling, Design & Stimulating", Prentice Hall,2003.
3. Boudreau, M.A. and McMillan, G.K.," New Directions in Bioprocess Modelling and Control", ISA,2006.
4. Hangos, K.M. and Cameron, I.T., "Process Modelling and Simulation",2001.
5.Heinzle, E., Biwer, A.P. and Cooney, C.A.L., "Development of Sustainable Bioprocess: Modeling", Wiley,2007.

MTBT-127: BIOTECHNOLOGY LAB –II

Course objectives:

- To let the students know the recent evolution biological databank usage
- To provide hands on experience in performing basic recombinant technique

Course Outcomes:

1. Develop Bioinformatics tools with programming skills
2. Apply computational based solutions for biological perspectives
3. Describe principle, methods for preparation & cloning of DNA
4. Able to use biotechnology techniques to manipulate genetic material and develop new and improved living organisms

Bioinformatics Lab:

1. Sequence formats
2. Structure formats
3. Sequence Retrieval from NCBI-GenBank using Entrez
4. Sequence Retrieval from EMBL-ENA using SRS
5. Sequence Retrieval from DDBJ using ARSA
6. Protein Sequence Retrieval from Swiss-Prot
7. Protein Sequence Retrieval from PIR-PSD
8. Protein Structure Retrieval from RCSB-PDB
9. Searching Bibliography Databases
10. DotPlot
11. DotPlot using BioEdit
12. NCBI BLAST
13. Global Alignment
14. Local Alignment
15. Multiple Sequence Alignment using MEGA
16. Phylogeny using MEGA
17. Structural Visualization of proteins using RasWin
18. Restriction Mapping using BioEdit
19. ORF Finding using NCBI ORF Finder

Molecular Biology Lab:

1. Isolation of Genomic DNA
2. Isolation of Plasmid
3. Restriction Digestion
4. Ligation
5. Transformation
6. Southern Hybridization

ADVANCED SOIL MECHANICS

PCIVSMFE 111 | **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week | Sessional marks: 40
End Exam: 3 hours | End Exam Marks: 60

Course Objective:

The course contents enable the students to know the engineering properties of soils and determine the shear strength of cohesive and granular soils.

Course outcomes:

By the end of the course the students will be able to

1. Know the engineering properties of soils.
2. Understand the shrinkage and consolidation behaviour of soils.
3. Determine the shear strength of cohesive and granular soils.
4. Understand the deformation characteristics of soils.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	2	3	1	2	2	1	1	2	2	2	3	2	2
	2	3	3	3	2	1	2	2	1	1	2	2	3	3	2	2
	3	3	3	3	2	2	3	3	1	1	2	2	3	3	2	2
	4	3	3	3	2	1	3	3	1	1	2	2	3	3	2	2

SYLLABUS

UNIT – I

Engineering properties of soils: Engineering properties of granular soils, influence of clay phase, Atterberg limits, Activity, influence of exchangeable cations and pH, effects of organic matter.
Principle of effective stress: force distribution in a particulate system, inter particle forces, inter granular pressure. Shrinkage: Factors affecting shrinkage, Formation of cracks, Measurement of shrinkage

UNIT – II

Consolidation: Review of theory of one dimensional consolidation, laboratory consolidation tests, Estimation of total compression, Time and load deformation curves, load increment ratio, Soil structure in consolidation and compression – Sand drains – effect smear zone.

UNIT – III

Yield and failure: Principal Stresses and Principal planes; Mohr Circle of stress & strain; determination of pole - Concept of Yield and failure in soils, Yield criteria, Failure theories, Laboratory triaxial test for strength measurements.

Granular soil strength: Introduction, Friction Properties, Apparent friction Parameters, Sliding and interlocking friction, Laboratory measurement of Granular soil strength, measurement of friction angle, stress and strain, intrinsic friction angle, Volumetric strain.

UNIT – IV

Cohesive soil strength: Analytical and physical strength parameters, Porewater pressure, Components of Pore water pressure for fully saturated soil, Pore pressures in partially saturated clay, Pore water measurements, Skempton's Parameters, Pore pressure coefficients - laboratory determination – Stress Paths for various loading conditions – Undrained shear strength of anisotropic clay.

UNIT – V

Introduction to Critical state soil mechanics: Effect of intermediate principle stress, anisotropy, Resistance to cyclic loading and liquefaction, Strength of mixed soils, Deformation characteristics, Elastic and plastic Deformation.

TEXT BOOKS

1. Mitchell, J. K. (2005), "Fundamentals of Soil Behaviour", John Wiley& sons, New Jersey, 3rd edition.
2. Yong, R. N. and Warkentin, B. P. (1975), "Soil Properties and Behaviour", Elsevier, New York.

REFERENCES

1. Das, B.M. (2008), "Advanced Soil Mechanics", Taylor & Francis, New York, 3rd edition.
2. Terzaghi, K. (1966), "Theoretical Soil Mechanics", John Wiley, New York.
3. Terzaghi, K. (1960), From Theory to Practice in Soil Mechanics. New York, NY: John Wiley and Sons Inc.
4. Davis, R.O. and Selvadurai, A.P.S. (1996), "Elasticity and Geomechanics", Cambridge University Press, Cambridge.
5. Scott, R.F. (1965), "Principles of Soil Mechanics", Addison –Wesley, London.
6. Wood, D.M (2007), "Soil Behaviour and Critical State Soil Mechanics", Cambridge university press, Cambridge.
7. Lambe, T. W. and Whitman, R. V. (2012), "Soil Mechanics-SI version", John Wiley &Sons, New York, 2nd edition.
8. Atkinson, J.H. and Bransby, P.L. (2000), "The mechanics of soils: An introduction to critical state soil mechanics", McGraw-Hill, New York.
9. Budhu, M. (2007), "Soil Mechanics and Foundations", Wiley-India edition, New Delhi.
10. Relevant NPTEL Courses

SOIL SCIENCE

PCIVSMFE 112 **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional marks: 40
End Exam: 3 hours End Exam Marks: 60

Course Objectives:

The course enables to understand the formation of soils, their mineralogy and various **mechanisms** involved in soil water interaction.

Course Outcomes:

At the end of the course the student will be able to:

1. Understand the Formation, Nature and Mineralogy soils
2. Gain knowledge about the Soil Fabric Structure and its characterisation
3. Apply concepts of water movement in Saturated and Unsaturated soils to measure unsaturated hydraulic conductivity.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2	3	2	1	2	2	1	1	-	-	2	3	2	2
	2	2	2	2	2	2	2	2	1	-	1	1	2	2	2	2
	3	2	2	1	2	1	1	2	1	-	1	-	2	2	1	2

SYLLABUS

UNIT – I

Soil Formation: Introduction: Weathering: Origin of clay minerals and clay genesis – soil profiles and their development. Sediment erosion – transport and deposition.
Nature of Soil: Particle size composition – Measurement of Pore size distribution – Principles of sedimentation analysis – Interpretation of accumulation Curves.

UNIT – II

Soil Mineralogy: Silicate Crystals - Surfaces – Gravel, Sand and Silt particles – Biogenic and Geochemical processes – Non-clay Mineral Characteristics.
Structural units of layer silicates – classification of clay minerals – Intersheet and InterLayer bonding – The 1:1 Minerals – Smectite Minerals – Mica like clay minerals – other clay minerals.

UNIT – III

Soil Fabric and Structure: Introduction – Structure and Fabric – Granular Soil packing – clay soil Fabric – Fabric classification – Particle arrangement in fabric units – First and Second order fabric characterization – Pore spaces and fabric – Techniques for direct fabric viewing – Quantification of fabric – Fabric characteristics from sedimentation.

UNIT – IV

Mechanism of Soil Water interactions – structures properties of adsorbed water – clay water electrolyte system. Ion distribution in clay water system - elements of double layer theory –

Influence of system variables on double layer theory – Limitations of Gouy-Chopman diffused double layer model – Energy and force of repulsions – long range attraction – Cation exchange.

UNIT – V

Flow through Soils: Soil water – capillarity - saturated flow: darcy's equations, determination of permeability in the field, Kozeny-Carmen Relationship – layered soils – factors effecting saturated flow – seepage force – Quicksand condition – Two dimensional flow - flownets and their characteristics – phreatic line for earthdams - uplift pressure – exit gradient – piping – filter criteria
Unsaturated flow: unsaturated flow equations for no volume change; for volume change cases Measurement of unsaturated hydraulic conductivity.

TEXT BOOKS

1. Mitchell, J. K. (1976), "Fundamentals of Soil Behaviour", John Wiley & Sons Inc.
2. Yong, R.N. and Warkentin B.P., (1975), "Soil Properties & Behaviour", Elsevier Scientific Publishing Company.

REFERENCES

1. Das, B.M. (2008), "Advanced Soil Mechanics", Taylor & Francis, New York, 3rd edition.
2. Lambe, T. W. and Whitman, R. V. (2012), "Soil Mechanics-SI version", John Wiley &Sons, New York, 2nd edition.
3. Atkinson, J.H. and Bransby, P.L. (2000), "The mechanics of soils: An introduction to critical state soil mechanics", McGraw-Hill, New York.
4. Relevant NPTEL Courses

ADVANCED FOUNDATION ENGINEERING

PCIVSMFE 113 **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional marks: 40
End Exam: 3 hours End Exam Marks: 60

Course Objective:

The course contents enable the students to learn the basic aspects of geotechnical engineering, analysis and structural design of foundations and retaining structures.

Course outcomes:

By the end of the course the students will be able to

1. Understand the basic concepts of foundation design.
2. Analyze the settlement of footings.
3. Understand the design and construction procedure of deep foundations
4. Design the foundations for transmission line towers.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	3	2	3	1	2	2	1	1	2	2	2	3	2	2
	2	3	3	3	2	1	2	2	1	1	2	2	3	3	2	2
	3	3	3	3	2	2	3	3	1	1	2	2	3	3	2	2
	4	3	3	3	2	1	3	3	1	1	2	2	3	3	2	2

SYLLABUS

UNIT – I

Foundation Design-general Principles: Types of Foundations, Basic requirement of a foundation, computation of loads, Design steps.

Shallow Foundations-I: Introduction, location and depth of foundation, Bearing Capacity of footings, Local and Punching shear failure, Skempton's Bearing capacity factor, footings on layered soils, Bearing capacity from penetration tests, Bearing capacity from Plate load test, factor of safety, soil pressure for structural design in normal and swelling soils.

UNIT – II

Shallow Foundations-II: Settlement of footings: Settlement from penetration tests, Stress path method for Settlement calculation, Settlement of footings on slope, Allowable Bearing Pressure, Allowable Bearing pressure of Raft foundation, Floating Raft, Uplift capacity of footings, Modulus of sub grade reaction. Beams on elastic foundation, design of circular and annular rafts.

UNIT – III

Pile Foundations: Introduction, Classification of piles, Bearing capacity of piles, Pile load test, Negative skin friction, Vertical pile subjected to lateral load, lateral load capacity of single pile, Batter piles under lateral loads, uplift capacity of piles, pile groups, Bearing capacity of a pile group, settlement of pile group, Negative skin friction in a pile group, uplift capacity of a pile group, Lateral pile load test, ultimate lateral load resistance of pile group, Hrennikoff's method, proportioning and design of pile foundations, bored piles – secant piles, tangent piles, intermittent piles, V – piles, Static installation, Box Jacking, piled raft.

UNIT – IV

Bridge substructures: Introduction, Elements of bridge substructures, determination of maximum flood discharge, determination of maximum depth of scour, depth of foundation, allowable bearing pressure, lateral stability of well foundation. Well foundations, Types of well foundations, sinking stresses in wells, tilts and shifts, sinking of wells, Design aspects of components of well foundations, Lateral stability of Well foundation.

UNIT – V

Foundations of Transmission Line Towers: Introduction, Necessary information, Forces on tower foundations, General design criteria, Choice and type of foundation, Design procedure.

TEXT BOOKS

1. Teng, W.C. (1983), "Foundation Design", John Wiley, New York.
2. Swami Saran (2006), "Analysis and Design of Substructures", Taylor& Francis, London, 2nd edition.

REFERENCES

1. Bowles, J.E. (2007), "Foundation Analysis and Design", McGraw-Hill, New York, 5th edition.
2. Vargheese, P.C. (2005), "Foundation Engineering", Prentice Hall of India, New Delhi.
3. Gopal Ranjan and Rao, A.S.R. (2007), "Basic and Applied Soil Mechanics", New Age International, New Delhi.
4. Poulos, H. G. and Davis, E. H. (1980), "Pile Foundation Analysis and Design", John wiley & sons, New York.
5. Tomlinson, M. J. (2001), "Foundation Design and Construction" , Prentice Hall, England, 7th edition.
6. Salgado, R. (2008), "The Engineering of Foundations", McGraw-Hill, Boston
7. Relevant I.S. Codes
8. Relevant NPTEL Courses

EARTH AND EARTH RETAINING STRUCTURES

PCIVSMFE 114 | **Credits: 3**

Instruction: 3 Lectures & 1 Tutorial / week | Sessional marks: 40

End Exam: 3 hours | End Exam Marks: 60

Course Objective:

The course contents enable the students to understand the earth pressure concepts and design principles of retaining structures.

Course outcomes:

By the end of the course the students will be able to

1. Understand the basic concepts of earth pressure theories.
2. Learn the design procedure of sheet pile walls
3. Know the types of bracing systems and cellular cofferdams.
4. Understand the construction techniques and design criteria of earth and rock fill dams.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	2	2	1	2	2	1	1	2	2	3	3	3	2
	2	3	3	3	2	1	2	2	1	1	3	3	3	3	2	2
	3	3	3	2	2	2	2	2	1	1	2	2	3	3	3	2
	4	3	3	3	2	2	2	2	1	1	3	3	3	3	2	2

SYLLABUS

UNIT – I

Earth Pressure: Basic concepts, Rankine and Coulomb earth pressure theories, Determination of active and passive pressures: Culmann's Graphical method, logarithmic spiral methods, friction circle method. Consideration of surcharge, seepage, earth quack, wave effect, stratification, type of backfill, wall friction and adhesion.

UNIT – II

Rigid Retaining Walls: Uses, types, stability and design principles of retaining walls, backfill drainage, settlement and tilting.

Sheet Pile Walls: Types, Design of cantilever sheet pile walls in granular and Cohesive soils; Design of anchored sheet pile walls by free and fixed earth support methods, Rowe's theory of moment Reduction, Design of anchors, Diaphragm Walls – construction, trench cutter.

UNIT – III

Braced excavations: Types of sheeting and Bracing systems, lateral earth pressure on sheeting in sand and clay, Design components of braced cuts. Cellular cofferdams: Types – Diaphragm and Circular type, Design by TVA method. Stability of cellular cofferdams, cellular cofferdams in rocks and soils.

UNIT – IV

Earth and Rock fill dams: Earth dams : Selection of Site, types of earthen dams, design criteria, stability analysis: upstream and down stream for steady seepage, rapid draw down, end of construction; Seepage, Uplift Control, filters and drains.

UNIT – V

Construction and Causes of Failure of earth dams: Construction - Hydraulic, Seepage and Structural Failure; Instrumentation and performance observations in earth dams. Rock Fill Dams: Types, Design parameters, Advantages over other types of dams

TEXT BOOKS

1. Arora, K.R. (2014), “Soil Mechanics and Foundation Engineering”, Standard Publishers, New Delhi, 7th edition.
2. Bharat Singh and Sharma, H. D. (1976), “Earth and Rockfill Dams”, Sarita Prakashan, India.

REFERENCES

1. Rowe, R.K. (2001), “Geotechnical and Geoenvironmental Engineering Handbook”, Springer, New York.
2. Narasinga Rao, B.N.D. (2015), “Soil Mechanics and Foundation Engineering”, Wiley Publishers, New Delhi, 1st Edition.
3. Taylor, D.W. (1967), “Fundamentals of Soil Mechanics”, John Wiley, New York.
4. Das, B. M. (2016), “Principles of Foundation Engineering”, Cengage learning, Boston, 8th edition.
5. Purushothama Raj, P. (1995), “Geotechnical Engineering”, Tata McGraw Hill, New Delhi.
6. Hsai-Yang Fang (2004), “Foundation Engineering Handbook”, CBS publishers & distributors, New Delhi, 2nd edition.
7. Clayton, C.R.I., Rick, I.W. and Andrew, J.B. (2014), “Earth pressure and earth-retaining structures”, CRC press, Florida, 3rd edition.
8. Relevant NPTEL Courses

NUMERICAL METHODS IN GEOTECHNICAL ENGINEERING

PCIVSMFE 115 **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional marks: 40
End Exam: 3 hours End Exam Marks: 60

Course Objective:

The course contents enable the students to know how complicated problems in engineering, which can not otherwise be solved, can be analyzed using numerical techniques.

Course outcomes:

By the end of the course the students will be able to

1. The students understand the procedure and applicability of different numerical methods and optimization techniques.
2. The students acquire knowledge needed to solve complicated engineering problems using numerical methods and optimization techniques.
3. The students will be able to develop computer program/applications for solving various mathematical methods involved in structural/geotechnical engineering.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	1	2	2	2	2	1	1	2	2	1	2	2	1	2
	2	3	2	1	2	2	1	2	2	2	2	1	2	3	2	2
	3	3	2	2	2	1	1	2	2	2	2	1	2	2	3	2

SYLLABUS

UNIT – I

Flexibility matrix method: Basics, formulation of method, application to two dimensional problems, Stiffness matrix method: Element & global stiffness matrix, rotation, translation, Matrix, translation to axis transformation, application to two-dimensional problems

UNIT – II

Solution of linear system of equations: Gaussian Elimination – Gauss Jordan Method – Gauss Siedel iteration method – Factorization method – Ill conditioned matrix. Numerical integration: Newton Cotes closed quadrature – Trapezoidal rule – Simpson's 1/3rd rule – 3/8 th rule – Newton Cotes open quadrature – Gaussian quadrature – Romberg integration.

UNIT – III

Partial differential equations: Laplace, Poisson and wave equation – Explicit and implicit methods. Solution of ordinary differential equations: Initial value problem – Euler's method – Picard's method – Taylor series – Predictor corrector methods – Runge-Kutta methods – Boundary value problems.

UNIT – IV

Solution of system of non linear equation: Newton-Raphson method. Curve fitting – Power curve – Exponential curve – Hyperbola –Cubic spline. Optimisation techniques: Linear programming – Simplex method – transportation problem – Non linear, Geometric and dynamic programming – elementary ideas.

UNIT – V

Application to Geotechnical Problems: Programming of simple geotechnical problems related to shallow and deep foundation, seepage, settlement etc.

TEXT BOOKS

1. Desai, C.S. & Christian, S.T. (1977), "Numerical methods in geotechnical engineering", McGraw Hill
2. Gerald (2003), "Applied Numerical Analysis", Pearson Education, New Delhi.

REFERENCES

1. Yashwant Kanetkar (1999), " Let us C", BPB publication, New Delhi
2. Akai T J (1994), "Applied Numerical methods for Engineers", John Wiley & Sons New York
3. Chapra, S.C. and Canale, R.P. (1985), "Numerical methods for Engineers", Tata Mc.Graw Hill Publishing Co. Ltd., New York.
4. Krishnamurthy, E. V. and Sen, S. K. (1986), "Numerical algorithms", East- West Press Pvt Ltd., New Delhi.
5. Rajasekharan, S. (1986), "Numerical methods in Science and Engineering", Wheeler & Co. Pvt. Ltd., New Delhi.

Elective - I
GEOTECHNICS OF PROBLEMATIC SOILS

PCIVSMFE 116 (a) **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional marks: 40
End Exam: 3 hours End Exam Marks: 60

Course Objectives:
To identify and classify various problematic soils and adopt foundation techniques for different problematic soils

Course Outcomes:
At the end of this course, the students will be able to:
1. Learn about the behaviour of expansive soil under various moisture conditions.
2. Identify expansive soils based upon various swell properties.
3. Understand about properties of soft clays and organic soils.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2	1	2	1	1	2	1	1	-	-	1	2	2	1
	2	2	2	2	2	1	2	2	1	-	1	1	1	2	3	2
	3	2	1	1	2	1	2	2	1	-	1	-	1	2	1	2

SYLLABUS

Unit – I
Introduction: Type of Damages and Heave, seasonal moisture variation, active zone, mechanism of swelling. Factors influencing heave, estimation of heave.

Unit – II
Identification and classification of expansive soil: swell potential, differential swell pressure. Free swell ratio, swelling pressure, Determination of swelling pressure, early methods-free swell ratio method, effective plasticity index.

Unit – III
Foundation techniques in expansive soils: foundation isolation, rigid foundations-underreamed pile foundation, Reinforced Slab-on-Grade Foundations.

Unit - IV
Control of soil moisture fluctuations, surface grading, subsurface drains, moisture barriers. Altering soil properties-controlled soil excavation and backfill, prewetting. Lime stabilization.

Unit – V
Soft clays: Geology of soft marine clays, mineralogy, physical properties, shear strength and compressibility, foundation types.
Organic and peaty soils, **Collapsible soils:** Geotechnical properties, foundation types.

TEXT BOOKS

1. Narasinga Rao, B.N.D. (2015), "Soil Mechanics and Foundation Engineering", Chapter - 24, Foundations on Expansive Soils, pp. 1039-1080, Wiley Publishers, New Delhi, 1st Edition.

REFERENCES

1. Ola, S.A. "Tropical soils in engineering practice", Balkema publications.
2. Metcaff, J. B., Butterworth,(1972), "Soil stabilization principles and practice",
3. Relevant NPTEL Courses

PAVEMENT ANALYSIS AND DESIGN

PCIVSMFE 116 (b) **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional marks: 40
End Exam: 3 hours End Exam Marks: 60

Course Objective

The course content enables students to learn the design of pavements and pavement management systems.

Course Outcomes

At the end of the course the student will be able to;

1. Categorize the types of pavements and design the flexible and rigid pavements.
2. Design the heavy duty pavements.
3. Learn the Concept of pavement evaluation and type of pavement distress.
4. Learn environment effects and pavement maintenance.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	-	1	3	2	1	1	2	2	2	2	2	2	2
	2	2	3	-	3	2	2	1	1	2	1	2	2	3	2	2
	3	3	2	2	2	1	2	1	1	1	1	2	1	2	2	2
	4	3	3	2	2	2	2	1	1	2	2	2	2	3	2	2

UNIT – I

Pavement types, stress distribution pavements - theoretical and actual Sub grade conditions and traffic loading. Design principle and methods for flexible and rigid pavements.

UNIT – II

Design of heavy duty pavements. Concrete block pavements.

UNIT – III

Evaluation of pavement condition, pavement instrumentation: Types of pavement distresses, their origins and remedy.

UNIT – IV

Roughness and skid resistance. Environmental effects and influences.

UNIT – V

Pavement maintenance, overlays. Pavement management systems.

TEXT BOOKS

1. Khanna, S.K. and Justo C.E.G. (2011), "Highway Engineering", Nem Chand & Bros Roorkee, 9th Edition.
2. Yang H. Huang (2012), "Pavement Analysis and Design", Pearson Education, New Jersey, 2nd Edition.

REFERENCES

1. Yoder, E.J. and Witczak, M.W. (1991), "Principles of Pavement Design", John Willey and Sons, New York, 2nd Edition
2. IRC – 37 – 2012, "Guideline for Design of Flexible Pavements", Indian Roads Congress, New Delhi.

RELIABILITY ANALYSIS

PCIVSMFE 116 (c) **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional marks: 40
End Exam: 3 hours End Exam Marks: 60

Course Objectives:

The course enables to enlighten the concepts of reliability based design in geotechnical engineering.

Course Outcomes:

At the end of the course the student will be able to

1. Basic understanding of the principles of reliability
2. Gain knowledge in Basic statistics like Data reduction techniques, Histograms, etc.
3. Design geotechnical structures on the principle of reliability based design with enhanced and optimal partial factors of safety.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2	1	2	1	1	2	1	1	-	-	1	2	2	1
	2	2	2	2	2	1	2	2	1	-	1	1	1	2	3	2
	3	2	1	1	2	1	2	2	1	-	1	-	1	2	1	2

SYLLABUS

UNIT – I

Concepts of Structural Safety: General, Design methods.
Basic Statistics: Introduction, Data reduction, Histograms, Sample correlation.

UNIT – II

Probability Theory: Introduction, Random events, Random variables, Functions of random variables, Moments and expectation, Common probability distribution, Extremal distribution.

UNIT – III

Resistance Distributions and Parameters: Introduction, Statistics of properties of concrete, Statistics of properties of steel, Statistics of strength of bricks and mortar, Dimensional variations, Characterization of variables, Allowable stresses based on specified reliability.
Probabilistic Analysis of Loads: Gravity loads, Wind load.

UNIT – IV

Basic Structural Reliability: Introduction, Computation of structural reliability. Monte Carlo Study of Structural Safety: General, Monte Carlo method, Applications.
Level 2 Reliability Methods: Introduction, Basic variables and failure surface, First-order second-moment methods (FOSM).

UNIT – V

Reliability Based Design: Introduction, Determination of partial safety factors, Safety checking formats, Development of reliability based design criteria, Optimal safety factors, Summary of results of study for Indian standard – RCC design. Reliability of Structural Systems: Preliminary concepts as applied to simple structures.

TEXTBOOKS

1. Ranganatham. R. (2006), "Structural Reliability Analysis and Design", Jaico Publishing House.
2. Melchers, R.E. (1999), "Structural Reliability", Wiley – Blackwell Publisher, 2^{nd} Edition.

SEMINAR

PCIVSMFE 117 **Credits: 3**
Instruction: 3 Tutorial / week Sessional marks: 50
End Exam: - End Exam Marks: 50

Course Objectives:

The objective of this course is

1. To develop an overview of geotechnical engineering and its importance.
2. To promote teamwork and lifelong learning among the students.

Course Outcomes:

At the end of the course the students will be able to

1. Improve the communication skills and cultivate lifelong learning.
2. Broaden their knowledge about Geotechnical Engineering and its significance
3. Update their knowledge on the latest developments in geotechincal engineering.
4. Understand the environmental, safety, economical and sustainability aspects of any geotechnical engineering structure.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	-	-	-	-	-	-	-	-	-	3	-	2	-	-	-
	2	2	2	2	2	2	2	2	-	-	-	-	-	2	2	2
	3		2	2	2	2	2	2	-	-	-	-	-	2	2	2
	4	-	-	2	-	-	2	2	-	-	-	-	-	2	-	2

SYLLABUS

Each student has to select a topic and collect about 10 papers with at least 5 journal papers and prepare a report and give a seminar at the end the semester.

SOIL ENGINEERING LAB

PCIVSMFE 118 **Credits: 3**
Instruction: 3 Practical / week Sessional marks: 50
End Exam: 3 hours End Exam Marks: 50

Course Objectives:

To enable a student to understand the various index and engineering properties of soil by experimentation

Course Outcomes:

By the end of the course, student will be able to:

1. Determine index and engineering properties of different soils and understand their behaviour.
2. Gain basic knowledge towards geophysical testing techniques.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2	2	3	2	1	1	1	3	3	1	2	3	2	2
	2	2	1	2	2	1	2	1	1	2	2	2	2	2	2	2

SYLLABUS

Soil Laboratory

1. Determination of hygroscopic content, specific gravity and gradation characteristics of soils.
2. Determination of Atterberg Limits of soils.
3. Determination of compaction characteristics of soils.
4. Determination of permeability of soils by using constant head method.
5. Determination of permeability of soils by using variable head method.
6. Determination of consolidation characteristics of soils.
7. Determination of shear strength parameters of soils using direct shear test.
8. Determination of shear strength parameters of soils using unconfined compression strength test.
9. Determination of shear strength parameters of soils using triaxial compression test (UU).
10. Determination of Swell Pressure using Swell-Consolidation test/Constant volume method.

GROUND IMPROVEMENT TECHNIQUES

PCIVSMFE 121 | **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week | Sessional marks: 40
End Exam: 3 hours | End Exam Marks: 60

Course Objective:

The course content enables students to learn the different techniques for enhancing engineering properties of soil.

Course Outcomes:

At the end of the course the student will be able to;

1. Explain the method of Ground Improvement by Mechanical Stabilization.
2. Learn the grouting techniques.
3. Learn the concept of Vertical drains, its construction and design principles.
4. Outline the Soil Nailing and Dewatering Techniques.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2	3	2	2	2	2	2	1	1	1	1	2	2	1
	2	2	2	3	2	3	2	2	1	1	-	2	1	2	2	2
	3	3	2	3	2	3	2	2	2	1	1	2	2	3	2	2
	4	3	2	3	2	3	2	3	1	2	1	2	2	3	2	2

SYLLABUS

UNIT – I

Introduction – Need for Ground Improvement, Objectives of Ground Improvement, Classification of Ground Improvement Methods, Mechanical Stabilization- Triangular Chart Method and Rothfutch Method, Blasting, Dynamic Compaction/ Consolidation, Compaction piles – Micro piles: Design methods and construction techniques.

UNIT – II

Soil & Foundation Grouting – Grouting Equipments, Applications, Classification of grouting based on Materials, Grouting Technique and Sequence of Operation, Soilcrete, Soilfrac, grouting in rocks,

UNIT – III

Vertical Drains- Sand Drains, Vacuum Consolidation, Prefabricated - Principle, Band Drains or Wick Drain, Geosynthetic Drains, Construction, Advantages and Disadvantages, Stone Columns – Mechanism of load transfer, Design principles, Construction of stone column- Vibro Compaction, Vibro Replacement, Vibro Composer and Case bore hole Methods, Geotextile Coated Stone Columns, Preloading.

UNIT – IV

In- Situ Soil Mixing – Types of In-situ Soil Mixing, Benefits and Applications, Ground Freezing and Ground Heating.
Soil Nailing – Components, Types of soil nailing systems, Equipment used, Construction of Soil Nailing System, Stability Analysis, Application, Advantages, Gabions.
Methods to improve rock mass – rock bolting and rock anchors - Beach management system.

UNIT – V

Seepage Control & Dewatering- Definition, Objectives, Methods of Dewatering- Open Sumps and Ditches, Well point Systems, Deep Well Systems, Vertical Sand Drains, Electro-Osmosis, Cut off wall, Selection of Dewatering System, Cathodic protection of marine structures.

TEXT BOOKS

1. Purushothama Raj, P. (1999), "Ground Improvement Techniques", Laksmi Publications, New Delhi.
2. Narasinga Rao, B.N.D. (2015), "Soil Mechanics and Foundation Engineering", Wiley Publishers, New Delhi, 1st Edition.

REFERENCES

1. Hausmann, M. R. (1990), "Engineering Principles of Ground Modifications", McGraw Hill Pub Co., New York.
2. Moseley, M.P. and Kirsch, K. (2004), "Ground Treatment", Spon Press, New York, 2nd Edition.
3. Das, Braja M. (2016), "Principles of Foundation Engineering", Cengage learning, Boston, 8th Edition.
4. Nayak, Narayan V (1996), "Foundation Design Manual: For Practising Engineers and Civil Engineering Students", Dhanpat Rai, New Delhi, 4th Edition.
5. Relevant NPTEL Courses

GEOENVIRONMENTAL ENGINEERING

PCIVSMFE 122 **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional marks: 40
End Exam: 3 hours End Exam Marks: 60

Course Objectives:
From this course students will learn the following

1. To characterize waste based upon its source and safe transport and disposal of waste without any contamination.

Course Outcomes:
1. Learn about various sources and characteristics of site.
2. Understand about classification of waste and environmental concerns of waste.
3. Know about the safe transport and disposal methods of hazardous waste.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	2	1	2	1	2	3	1	1	1	-	1	2	1	2
	2	1	2	1	2	1	2	3	1	-	1	-	1	1	2	1
	3	2	2	2	2	1	2	3	1	-	1	1	1	2	2	2

SYLLABUS

UNIT – I

Sources and Site Characterization: Scope of Geoenvironmental Engineering, Various Sources of Contaminations, Need for contaminated site characterization; and Characterization methods.

UNIT – II

Solid and Hazardous Waste Management: Classification of waste, Characterization solid wastes, Environmental Concerns with waste, waste management strategies.

UNIT – III

Contaminant Transport: Transport process, Mass-transfer process, Modelling, Bioremediation, and Phytoremediation. Remediation Techniques: Objectives of site remediation, various active and passive methods, remediation NAPL sites, Emerging Remediation Technologies.

UNIT – IV

Landfills: Types of landfills, Site Selection, Components of Waste Containment system, Leachate collection system, Cover system, Gas collection system.

UNIT – V

Soil erosion and conservation – causes of soil erosion, factors contributing to erosion – climatic factors, topographical factors, vegetation factors. Erosion control – cropping systems, gullies, check dams, contouring, wind striping, ridging, bank protection.

TEXT BOOKS

1. Sharma, H. D. and Reddy, K. R. (2004), "Geoenvironmental Engineering", John Wiley & Sons

REFERENCES

1. Rowe, R. K. (2001), "Geotechnical & Geoenvironmental Engineering Handbook", Kluwer Academic
2. Reddi, L. N. and Inyang, H. I. (2000), "Geoenvironmental Engineering Principles and Applications", Marcel. Dekker, Inc., New York .
3. LaGrega, M. D., Buckingham, P. L. and Evans, J. C. (2001), "Hazardous Waste Management", McGraw-Hill, New York.
4. Daniel, D. E. (1993), "Geotechnical practice for waste disposal", Chapman and Hall, London.
5. Oweis, I.S. and Khera, R.P. (1998), "Geotechnology of Waste Management", PWS Publishing Co., New York, 2nd Edition.
6. Bagchi, A. (2004), "Design of Landfills and Integrated Solid Waste Management", John Wiley & Sons, New Jersey, 3rd Edition.
7. Relevant NPTEL Courses

GEOSYNTHETICS AND REINFORCED SOIL STRUCTURES

PCIVSMFE 123 | **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week | Sessional marks: 40
End Exam: 3 hours | End Exam Marks: 60

Course Objective:

The course content enables students to learn the use of Geosynthetics in Civil Engineering, modern concepts of Soil Reinforcement, design principles and ease of their applicability to construction practices.

Course Outcomes:

At the end of the course the student will be able to;

1. Explain the significance of Geosynthetics, Properties of Geotextiles and its application.
2. Design with Geotextiles.
3. Learn the Concept of Reinforced Earth.
4. Design the Reinforced Earth Retaining Walls, Reinforced Pavements, and Landfills.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	2	1	3	2	3	1	2	2	2	2	2	2	2
	2	2	3	3	3	2	2	2	1	2	1	2	2	3	2	2
	3	3	2	3	2	1	2	2	1	1	1	2	1	2	2	2
	4	3	3	3	2	2	2	3	2	2	2	2	2	3	2	2

SYLLABUS

UNIT – I

Geosynthetics-Types, Functions, Applications, Raw materials, Manufacturing methods.

UNIT – II

Properties of Geotextiles- Physical Properties, Mechanical Properties, Hydraulic Properties, Survivability and Durability.

Tests on Geotextiles- Mass per unit area, Nominal Thickness, Apparent Opening Size, Characteristic Opening Size, Tensile Strength-Strip Tensile Strength, Wide Width Tensile Strength, Grab Tensile Strength, Seam strength, Static Puncture test- CBR push through test, Rod Puncture Test, Dynamic Puncture Test- Cone Drop test, Permittivity, Transmittivity.

UNIT – III

Designing with Geosynthetics: Designing with Geotextiles-Design Methods, Designing for separation, Designing for Highway Reinforcement, Designing for Filtration, Designing for drainage, Designing for Multiple functions, Construction Methods and Techniques using Geotextiles. Designing with Geogrid, Geonets, Geomembranes, Geocomposites

UNIT – IV

Reinforced Earth: Concept, Effects of Reinforcement on soils – Equal Confining and Pseudo Cohesion Concepts, Materials, Friction Coefficient – Definition, Laboratory determination, Factors affecting fiction coefficient; Telescope and Hitex Methods of construction, Application of Reinforced Earth – Binquet & Lee's Approach for analysis of foundations with reinforcement layers.

UNIT – V

Reinforced Earth Retaining Walls: Introduction, Stability Mechanisms, Design of Reinforced Earth Retaining Wall, Advantages over conventional Retaining Walls
Reinforced Pavements: Benefits of placing reinforcement in flexible pavement layers, design of reinforced pavements by Giroud and Noiray approach and modified CBR Method.
Landfills: Geosynthetic applications for land fill liners, covers and other components

TEXT BOOKS

1. Venkatappa Rao, G. and Suryanarayana Raju, G.V.S. (1990), "Engineering with Geosynthetics", Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Koerner, R. M., (2012) "Designing with Geosynthetics", Xlibris Corp, New York, 6^{th} Edition.

REFERENCES

1. Siva Kumar Babu, G.L. (2006), "An Introduction to Soil Reinforcement and Geosynthetics", Universities Press, Hyderabad.
2. Robert M. Koerner (1991), "Construction and Geotechnical Methods in Foundation Engineering", McGraw Hill, New York.
3. Hausmann, M. R. (1990), "Engineering Principles of Ground Modifications", McGraw Hill Pub Co., New York.
4. BS 8006:2010, "Code of practice for strengthened/reinforced soils and other fills".
5. FHWA-NH1-00-043, (2014) "Mechanically stabilized earth walls and reinforced soil slopes design and construction guidelines".
6. John, N.W.M. (1999), "Geotextiles", Blackie, New York, 2^{nd} Edition.
7. Relevant NPTEL Courses

DYNAMICS OF SOILS AND FOUNDATIONS

PCIVSMFE 124 | **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week | Sessional marks: 40
End Exam: 3 hours | End Exam Marks: 60

Course Objectives:

The course enables to understand the theory of vibrations, dynamic properties of soil and apply them in design foundations for machines.

Course Outcomes:

At the end of the course the student will be able to

1. Understand the concept of vibrations in soil-structure medium.
2. Know the dynamic properties of soil and their importance
3. Gain knowledge about the importance of designing machine foundations.
4. Demonstrate the ability to design machine foundations

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2	1	2	1	2	3	1	1	1	-	1	2	2	3
	2	2	2	2	2	1	2	3	1	-	1	-	1	2	2	3
	3	2	2	2	2	1	2	3	1	-	1	1	1	2	2	3
	4	2	2	2	2	1	2	3	1	-	1	1	1	2	2	3

SYLLABUS

UNIT – I

Theory of Vibrations: Free and forced vibrations with and without damping for single mass system with single degree freedom, Logarithmic Decrement and Damping Ratio, Principles of Design of Vibration measuring Devices, Transmissibility of force, vibrations of Two degree freedom system, vibrations of Systems under transient loads.

UNIT – II

Natural frequency of foundation soil system- Barkan's Method, Pressure Bulb Concept, Pauw's Analogy, Tschebetorioff's concept of reduced natural Frequency

UNIT – III

Dynamic Soil Properties: Tests for determination of dynamic soil properties - Cyclic Plate load test, Block vibration test, Up Hole, down Hole and Cross Hole wave Propagation tests, Hammer Test, Resonant Column Test, Seismic Reflection and Refraction tests.

UNIT – IV

Design of Machine Foundation: Types of Machine Foundations, design criteria, Degrees of Freedom of Block foundation, Analysis of Block foundations under sliding, rocking, yawing and Coupled motions, Design Aspects and Construction details of foundations for reciprocating and Impact,

UNIT – V

Vibration Isolation - Passive and active isolation - use of springs and damping materials construction aspects of machine foundations.

TEXT BOOKS

1. Swami Saran, (1999),"Soil Dynamics and Machine Foundations", Galgotia Publications Private Ltd, New Delhi, 2nd Edition.
2. N. S. V. Kameswara Rao, (1998),"Vibration Analysis and Foundation Dynamics", Wiley New Delhi, 1st Edition

REFERENCES

1. Das, B. M. and Ramana, G.V. (2010),"Principles of Soil Dynamics", CL Engineering, Punjab, 2nd Edition.
2. Narasinga Rao, B.N.D. (2015), "Soil Mechanics and Foundation Engineering", Wiley Publishers, New Delhi, 1st Edition.

ROCK MECHANICS

PCIVSMFE 125 **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional marks: 40
End Exam: 3 hours End Exam Marks: 60

Course Objective

The course content enables students to learn the Rock structure, properties, strength and failures.

Course Outcomes

At the end of the course the student will be able to;

1. Classify the rocks and defects in rocks.
2. Learn the different properties of rocks.
3. Learn the different tests on rocks.
4. Outline the Creep behaviour, strength and failure of rock.

Mapping of course outcomes with program outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	3	2	2	2	2	2	1	1	1	1	2	2	1
	2	2	2	3	2	3	2	2	1	1	-	2	1	2	2	2
	3	3	2	3	2	3	2	2	2	1	1	2	2	3	2	2
	4	3	2	3	2	3	2	3	1	2	1	2	2	3	2	2

UNIT – I

Introduction: Structure of the Earth, Classification of Rocks - Igneous Rocks, Metamorphic Rocks and Sedimentary Rocks, Sequence of formation of Different groups of Rocks, Rock cycle.
Sub-Surface Exploration: Introduction – Planning and stages in sub-surface exploration – Methods of exploration – Test pit – Trenches – Seismic refraction and Electrical resistivity method – Methods of Boring – Types of soil sample – Design Features of soil sampler – standard penetration test – static and dynamic cone penetration test – Pressuremeter test – Rock exploration – Core boring – Core Recovery – RQD - bore log – preparation of sub-soil investigation report.

UNIT – II

Defects in Rock Mass- Strike and Dip, Bedding Planes, Joints, Faults, Folds, Unconformity and their Civil Engineering Importance.
Physical and index Properties of Rocks: Texture, Structure, Composition, Colour, Grain Size, Durability and Rock Quality Designation.
Mechanical Properties: Compressive Strength, Tensile Strength, Shear Strength, Point Load Strength, Scale Effect, Elasticity, Plasticity, Poisson's Ratio, Deformability, Hardness.

UNIT – III

Laboratory Testing on Rocks: Sampling, Sample Preparation, Specimen, Uniaxial Compressive Strength test, Tensile strength test, Brazillian test, flexure strength Test, Flexural strength Test, Shear Strength Test, Test for Elastic Constants

UNIT – IV

Insitu Tests on Rocks: Deformability- Cable Jacking Test, Pressure Tunnel Test, Bore hole Test, Shear Tests- Single Jack Test, Strength Test- Pressuremeter Test, Dilatometer Test, Stress Relief Techniques, Insitu Stress?, Hydro fracturing technique, Flat Jack Techniques, Indirect Methods.

UNIT – V

Strength and Failure of Rocks: Failure Criteria in Rock Masses, Yield Criteria of Failure Theories- Maximum Stress Theories, Maximum Elastic Strain Theories, Constant Elastic Strain Energy Theory, Maximum Shear Stress Theory, Mohr's Theory, Coulomb Theory, Griffith's Theory of Fracture Initiation- Stress Around Boundary of an open flow and Equations defining Fracture Initiation.
Foundation on rocks: Estimation of bearing capacity – stress distribution in rocks – settlement in rocks – pile foundation in rocks.

TEXTBOOKS

1. Verma, B. P. (2006), "Rock Mechanics for Engineers", Khanna Publishers, New Delhi, 3rd Edition.
2. Ramamurthy, T. (2007), "Engineering in Rocks for Slopes, Foundations and Tunnels", PHI Learning Private Limited, New Delhi, 2nd Edition.

REFERENCES

1. Brown, E.T. (1981), "Rock Characterisation, Testing and Monitoring", Pergamon Press, London, 1st Edition.
2. Singh, B. and Goel, R. K. (1999), "Rock Mass Classification Systems – A Practical Approach in Civil Engineering", Elsevier Publisher, New York, 1st Edition.
3. Narasinga Rao, B.N.D. (2015), "Soil Mechanics and Foundation Engineering", Wiley Publishers, New Delhi, Chapter – 14, pp. 529 – 578, 1st Edition.
4. Richard, E. Goodman (1989), "Introduction to Rock Mechanics", John Wiley & Sons, New York, 2nd Edition.
5. Relevant NPTEL Courses

FINITE ELEMENT METHODS FOR GEOTECHNICAL ENGINEERING

PCIVSMFE 126 (a) **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional marks: 40
End Exam: 3 hours End Exam Marks: 60

Course Objectives:

The course enables to understand the concept of finite element analysis and its applications in geotechnical engineering.

Course Outcomes:

At the end of the course the student will be able to

1. Understand in general how finite elements are obtain to approximate the solutions of differential equations
2. Apply finite element methods to classical geotechnical problems like settlement, seepage, consolidation, slope stability, etc.
3. Obtain insight into the soil properties needed for finite element analysis

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	2	2	3	2	3	1	1	1	-	2	3	2	3
	2	3	2	2	2	3	2	3	1	-	1	-	2	3	2	2
	3	3	2	2	2	3	2	3	1	-	1	1	2	3	2	3

SYLLABUS

UNIT – I

Introduction: Concepts of FEM, Steps involved in Finite Element Analysis Procedure, Merits and Demerits. Principles of Elasticity: Stress equations, Strain-Displacement relationships in matrix form, Plane stress, Plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

UNIT – II

Element Properties: Concept of an element, various element shapes, Displacement models, Generalized coordinates, Shape functions, Convergent and Compatibility requirements, Geometric invariance, Natural coordinate system - area and volume coordinates.

UNIT – III

Generation of Element Stiffness and Nodal Load Matrices, Isoparametric Formulation: Concept, Different isoparametric elements for 2D analysis, formulation of 4-noded and 8-noded isoparametric quadrilateral elements, Lagrangian elements, Serendipity elements.

UNIT – IV

Assemblage of Elements: Discretization of a structure, numbering systems, Aspect ratio its effects, Assemblage, Direct Stiffness method, Interface Elements.

UNIT – V

Geotechnical Applications Sequential construction, Excavations and embankments, Bearing capacity and Settlement analysis.

TEXT BOOKS

1. Chandrupatla, R. T. and Ashok D. B., (2011) “Introduction to Finite Element in Engineering”, Pearson, Hyderabad, 4th Edition.
2. Cook, R.D., Malkus, D. S., Michael, E. P. and Robert J. W., (2001), “Finite Elements Analysis – Concepts & Applications” John Wiley & Sons, New Delhi, 4th Edition

REFERENCES

1. Desai, C. S. and J.F. Abel, (1972), “Introduction to the Finite Element Method”, Van Nostrand Reinhold Company.
2. Zienkiewicz, O. C., (1971), “Finite element Methods”, McGraw-Hill Publishers, New Delhi,
3. Krishna Murthy, C. S., (1994), “Finite element analysis - Theory and programming”, Tata McGraw-Hill.

GEOTECHNICS OF UNDERGROUND STRUCTURES

PCIVSMFE 126 (b) **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional marks: 40
End Exam: 3 hours End Exam Marks: 60

Course Objective:

The course contents enable the students to learn about various underground structures and their design concepts.

Course outcomes:

By the end of the course the students will be able to

1. Know about the types of conduits and soil pressure on conduits.
2. Learn the construction of earth tunnels.
3. Learn the design concepts of tie backs and braced cuts.
4. Understand the soil nailing concepts.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	3	2	2	2	1	2	2	1	1	2	1	3	3	3	2
	2	3	2	2	2	2	2	2	1	1	2	1	3	3	3	2
	3	3	3	3	2	1	2	2	1	1	2	1	3	3	3	2
	4	3	3	2	2	2	2	2	1	1	2	1	3	3	3	2

SYLLABUS

UNIT – I

Arching in soils: prerequisites and features of arching, Theory of arching in soils, Application of arching in cohesive frictional soils.

UNIT – II

Soil pressures on conduits: Loads on ditch, negative and positive projecting conduits, Bedding conditions for conduits and types of conduits, Pressures in silos, Janssen's theory for pressures in silos.

UNIT – III

Stresses: Stresses in Vicinity of Vertical Shafts, Tunnels, Construction of Earth Tunnels. Retaining Systems for Underground Excavations.

UNIT – IV

Braced Cuts: Lateral Earth pressure on Sheeting, Types of Sheeting and Bracing Systems, Design of Braced Cuts
Tie Backs: Components, advantages over Braced Cuts, Design concepts

UNIT – V

Soil Nailing: Components of nailing system, Driven and Grouted Nails, Design of nailing system, anchored Spider Netting. Types of Anchorage Systems for anchored Sheet pile walls, Design of anchorages, considerations in positioning of anchorages.

TEXT BOOKS

1. Leonards, G.A. (1962), "Foundation Engineering", McGraw-Hill, New York.
2. Shamsher Prakash, Gopal Ranjan and Swami Saran (1987) "Analysis and Design of Foundations and Retaining Structures", Sarita Prakasha, Meerut, 2nd edition.

REFERENCES

1. Arora, K.R. (2014), "Soil Mechanics and Foundation Engineering", Standard Publishers, New Delhi, 7th edition.
2. Das, B.M. (2017), "Fundamentals of Geotechnical Engineering", Cengage learning, Boston, 5th edition.
3. Purushothama Raj, P. (1995), "Geotechnical Engineering", Tata McGraw Hill, New Delhi.
4. Relevant NPTEL Courses

MARINE SUBSTRUCTURES

PCIVSMFE 126 (c) **Credits: 3**
Instruction: 3 Lectures & 1 Tutorial / week Sessional marks: 40
End Exam: 3 hours End Exam Marks: 60

Course Objectives:

The course enables to understand various marine sub-structures, their working and preliminarily design of the sub-structures

Course Outcomes:

At the end of the course the student will be able to

1. Understand the definition and purpose of marine or sub-structures.
2. Gain knowledge about the load calculations on sub-structures.
3. Apply the concepts of the preliminary design concepts of marine sub-structures.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2	2	2	1	2	2	1	1	-	-	2	2	2	2
	2	2	2	2	2	2	2	2	1	-	1	1	2	2	2	2
	3	2	2	2	2	1	2	2	1	-	1	-	2	2	2	2

SYLLABUS

UNIT – I

Introduction: Offshore definition, Purpose of Offshore Structures, Classification and Examples, Various types of Offshore Structures – Jacket Platforms, Semi submersibles, Tension Leg Platforms, Gravity Platforms Guyed Towers, Articulated Towers.
Load Calculations: Environmental loads on offshore structures due to a)Wind b) Wave c) Current d) Ice e) Earth quake, Functional loads, Buoyant Forces, Installation forces, Soil structure interaction. Wave force calculation on a Jacket platform and Semi submersible.

UNIT – II

Introduction, Coastal Protection works – Seawall – Groins – Structural aspects – Sand dunes – Vegetation – Beach nourishment.
Break waters – Types – Selection of site and type – Effects on the beach – Design principles of Rubble mound, vertical wall and composite Breakwaters – Stability of Rubble Structures.

UNIT – III

Wharves and Jetties – Types – Materials of Construction – Design Principles – Deck for fenders – Types – Design.
Dolphins – Mooring Accessories.

UNIT – IV

Submarine Pipelines – Route selection and Diameter / wall thickness calculations; Pipeline stability, free span calculations; Concrete coated pipelines and pipe-in-pipe insulated pipelines; Design using DNV 81 code.

UNIT – V

Preliminary design aspects of offshore structures. Construction, Towing and installation procedure of Jacket platforms and Gravity platforms.

TEXT BOOKS

1. Mark Randolph and Susan Gourvenec, (2011), "Offshore Geotechnical Engineering", CRC Press.

REFERENCES

1. Poulos, H.G., (1988), "Marine Geotechnics", Spon Press, London, UK.

DESIGN PROJECT

PCIVSMFE 127 | **Credits: 3**
Instruction: 3 Tutorial / week | Sessional marks: 40
End Exam: 3 hours | End Exam Marks: 60

Course objectives:

The objective of this course is to provide exposure to the students to the practical aspects of Civil Engineering projects

Course outcomes:

At the end of this course the student will be able to

1. Investigate and analyze at least one complex geotechnical engineering problem with substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
2. Select and apply appropriate techniques, resources, and modern engineering and IT tools to complex civil engineering activities with an understanding of the limitations.
3. Demonstrate knowledge and understanding of the engineering and management principles and apply these in designing at least one geotechnical engineering structure.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	-	2	-	-	-	-	-	-	-	-	-	-	2	-	-
	2	-	-	-	-	2		-	-	-	-	-	-	-	2	-
	3	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-

SYLLABUS

The students should carry out typical foundation design under varying soil conditions or revision of IS codes & IRC guidelines or any project suggested by course instructor. The design project may consist of

1. Soil and Structural Design of Combined footings, rafts
2. Design of Pile Groups
3. Design of Laterally loaded Piles
4. Design of well Foundations
5. Landfill Design
6. Reinforced Soil Structures
7. Design of Bulk heads
8. Case studies
9. Any other suitable topic

ADVANCED GEOTECHNICAL ENGINEERING LAB

PCIVSMFE 128 | **Credits: 3**
Instruction: 3 Practical / week | Sessional marks: 40
End Exam: 3 hours | End Exam Marks: 60

Course Objectives:

To enable a student to understand the various physical properties of Geosynthetics by experimentation

Course outcomes:

By the end of the course, student will be able to:

1. Determine physical properties of different types of Geosynthetics.
2. Gain basic knowledge towards rock specimen preparation and testing.

Mapping of course outcomes with program outcomes:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	2	2	3	2	1	1	1	3	3	1	2	3	2	2
	2	2	1	2	2	1	2	1	1	2	2	2	2	2	2	2

SYLLABUS

Geosynthetics Laboratory

1. Determination of physical properties of Geotextiles, Geogrids and Geomembranes
2. Determination of A.O.S of geotextiles
3. Determination of Grab and wide width tensile strengths of geotextiles
4. Determination of Interfacial frictional characteristics of Geotexiles with Fill material using modified direct shear test.
5. Determination of CBR Puncture Resistance of geotextiles
6. Determination of in plane and cross plane permeability of geotextiles

Demonstration

7. Evaluation of long term flow ability of geotextiles by Gradient ratio test
8. Cone Drop Test on geotextiles

Rock Mechanics Laboratory

1. Water absorption test for rock specimens
2. Point Load Test
3. Unconfined Compression Test on Rock specimens
4. Split Tensile Strength of Rock using Brazilian Test

Computational Laboratory

Students have to solve geotechnical problems using relevant software.

MECHANCIAL ENGINEERING DEPARTMENT

I YEAR – I SEMESTER

ADVANCED MECHANICS OF SOLIDS

Course Code: MECMD111	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

COURSE OBJECTIVES:

- To make students understand the advanced topics related to flat plates, torsion in rectangular and circular bars, stress concentration and experimental techniques, assumptions and analysis of contact stresses.

COURSE OUTCOMES:

The students will be able to:

CO1	Understand the crack propagations and their testing techniques for an out coming of various structures.
CO2	Design new components based on the concept of contact stresses
CO3	Design various mechanical systems subjected to torsional loads and different types of beams.

. **SYLLABUS**

Employability

UNIT – I

Flat plates: Introduction - Stress resultants in a flat plate - Kinematics: Strain - Displacement relations for plates - Equilibrium equations for small displacement theory of flat plates - Stress-strain-temperature relations for isotropic elastic plates - Strain energy of a plate - Boundary conditions for plates - Solutions of rectangular and circular plate problems.

Employability

UNIT – II

Torsion: Torsion of cylindrical bar of circular cross-section Saint-Venant's semi-inverse method - Linear elastic solution - The Prandtl elastic - Membrane (soap-film) analogy - Narrow rectangular cross-section - Hollow thin-wall torsion members: Multiply connected cross-section - Thin-wall torsion members with restrained ends - Fully plastic torsion.

UNIT – III

Beams on elastic foundation: General theory - Infinite beam subjected to concentrated load: Boundary conditions - Infinite beam subjected to a distributed load segment - Semi-infinite beam subjected to loads of its end - Semi-infinite beam with concentrated load near its end - Short beams - Thin-wall circular cylinders.

Employability

Employability

UNIT – IV

Stress concentrations: Basic concepts - Nature of a stress concentration problem. Stress concentration factor - Stress concentration factor. Theory of elasticity - Stress concentration factors. Experimental techniques - Stress gradients due to concentrated load - The stationary crack - Crack propagation. Stress intensity factor. Effective stress concentration factor: Applications - Stress concentration factor. Combined loads - Effective stress concentration factors - Effective stress concentration factors. Repeated loads - Effective stress concentration factors - Other influences - Effective stress concentration factors - In-elastic strains.

Employability

Employability

UNIT – V

Contact stresses: Introduction - The problem of determining contact stresses - Assumptions on which a solution for contact stresses is based - Notation and meaning of terms - Expressions for principal stresses - Method of computing contact stresses - Deflection of bodies in point contact - Stress for two bodies in contact over narrow rectangular area (line contact). Loads normal to area - Stresses for two bodies in line contact. Loads normal and tangent to contact area.

Employability

REFERENCE BOOKS:

1. Advanced Mechanics of Materials by Boresi, A.P. and Sidebottm, O.M.
2. Advanced Mechanics of Materials by Seely and Smith.
3. Advanced Strength of Materials by Den Hartog.
4. Advanced Strength of Materials by Timoshenko S.P.

MECHANCIAL ENGINEERING DEPARTMENT

I YEAR – I SEMESTER

MECHANICS OF MACHINERY

Course Code: MECMD112

L	T	P	C
4	**0**	**0**	**4**

COURSE OBJECTIVES

- To make the students to understand synthesis and analysis of complex mechanisms and concepts of cam dynamics.

COURSE OUTCOMES

The student will be able to

CO 1	Determine velocity and acceleration of various components in complex mechanisms by applying graphical and analytical methods
CO 2	Understand the concepts of synthesis and use it for the design of mechanical systems
CO 3	Understand Cam dynamics and use it in designing of Cams

. **SYLLABUS**

UNIT-I:

Kinematics of complex mechanisms - Complex mechanisms, Low and high degree of complexity, Goodman's indirect acceleration analysis, Method of normal accelerations, Hall and Ault's auxiliary point method, Carter's method and comparison of methods.

Employability

UNIT-II:

Advanced kinematics of plane motion - The inflexion circle - Euler-Savary equation, Analytical and graphical determination of diameter of inflection circle - Bobbileier's construction, Collineation axis - Hartman's construction, Application of inflection circle to kinematic analysis - Polode curvature - General case and special case, Polode curvature in the four-bar mechanism - Coupler motion, Relative motion of the output and input links, Freudenstein'scollineation axis theorem - Carter Hall circle, Circling-point curve (general case).

Employability

UNIT-III:

Introduction to synthesis (graphical methods) guiding a point through two, three and four distinct positions - Burmaster's curve, Function generation - Overlay's method, Path generation - Robert's theorem.

Employability

UNIT-IV:

Introduction to synthesis (analytical methods) - Freudenstein's equation - Precision point approximation - Precision derivative approximation - Method of components - Block synthesis and Reven's method.

UNIT-V:

Cam dynamics - Forces in rigid systems, Mathematical models, Response of a uniform - Motion undamped cam mechanism - Analytical method, Follower response by phase - Plane method - Position error, Jump, Crossover shock - Johnson's numerical analysis.

Employability

REFERENCE BOOKS:

1. Kinematics and Dynamics of Plane Mechanisms by J. Hirschhorn, McGraw Hill Book Co., 1962.
2. Theory of Mechanics by J.E. Shigley, McGraw Hill Book Co., 1961 .
3. Theory of Mechanisms and Machines/ Amitabh Ghosh and Ashok Kumar Mallik/ E. W.P.Publishers
4. Kinematics and Linkage Design/ Allen S.Hall Jr./ PHI,1964.

5. Kinematics and Dynamics of Machinery/Charles E Wilson/Pearson/3rd Edition

I YEAR – I SEMESTER

ADVANCED OPTIMIZATION TECHNIQUES

Course Code: MECMD113

L	T	P	C
4	**0**	**0**	**4**

COURSE OBJECTIVES:

The objective of the course is to provide students

- Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively;
- Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry;
- Skills in the use of optimization approaches and computer tools in solving real problems in industry;
- Ability to develop mathematical models for analysis of real problems in optimization

COURSE OUTCOMES:

The students will be able to:

CO1	Recognize the importance and value of optimization and mathematical modeling in solving practical problems in industry.
CO2	Formulate a managerial decision problem into a mathematical model.
CO3	Understand optimization models and apply them to real-life problems.
CO4	Use computer tools to solve a mathematical model for a practical problem.

SYLLABUS

Skill Development & Employability

UNIT I

Geometric programming (G.P): Solution of an unconstrained geometric programming, differential calculus method and arithmetic method. Primal dual relationship and sufficiency conditions. Solution of a constrained geometric programming problem (G.P.P), Complementary Geometric Programming (C.G.P)

Skill Development & Employability

UNIT II

Dynamic programming(D.P): Multistage decision processes. Concepts of sub optimization and Principal of optimality, computational procedure in dynamic programming calculus method and tabular methods. Linear programming as a case of D.P. and continuous D.P.

Skill Development & Employability

UNIT III

Integer programming(I.P): Graphical representation. Gomory's cutting plane method. Bala's algorithm for zero-one programming problem. Branch-and-bound method, Sequential linear discrete Programming, Generalized penalty function method.

Skill Development & Employability

UNIT IV

Stochastic Programming (S.P.): Basic Concepts of Probability Theory, Stochastic Linear programming.

Skill Development & Employability

UNIT V

Non-traditional optimization techniques: Multi-objective optimization - Lexicographic method, Goal programming method, Genetic algorithms, Simulated annealing, Neural Networks based Optimization.

REFERENCE BOOKS:

1. Operations Research- Principles and Practice by Ravindran, Phillips and Solberg, John Wiely
2. Introduction to Operations Research by Hiller and Lieberman, Mc Graw Hill
3. Engineering Optimization - Theory and Practice by Rao, S.S., New Age International (P) Ltd. Publishers.
4. Engineering Optimization By Kalyanmanai Deb, Prentice Hall of India, New Delhi.
5. Genetic Algorithms - In Search, Optimization and Machine Learning by David E. Goldberg, Addison-Wesley Longman (Singapore) Pvt. Ltd.

I YEAR – I SEMESTER

DESIGN ENGINEERING

Course Code: MECMD114	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

COURSE OBJECTIVES:

To develop the ability:

- To identify different design models, steps involved in it and he ability to apply the fundamentals of product design and manufacturing design techniques for metallic and non metallic parts along with material selection criteria in design.
- To gain knowledge of economic factors, human engineering, ergonomics, and value engineering and modern approaches in design.
- To find static failure theories, surface failures and fatigue strengths.

COURSE OUTCOMES:

The students will be able to:

CO1	Approach a design problem successfully, taking decisions when there is not a unique answer.
CO2	Devise a list of concepts for a design application using idea-generation techniques for product design, material selection and design for manufacturing along with their failures and fatigue strengths.
CO3	Use proficiently the economic factors, human engineering, ergonomics, and value engineering and modern approaches in design.

. **SYLLABUS**

Unit-I

Employability

Design philosophy: Design process, Problem formation, Introduction to product design, various design models-Shigley model, Asimov model and Norton model, Need analysis, Strength considerations -standardization. Creativity, Creative techniques, Material selections, Notches and stress concentration, design for safety and Reliability

Employability

Employability

Unit –II

Product Design: Product strategies, Product value, Product planning, product specifications, concept generation, concept selection, concept testing.

Design for manufacturing: Forging design, Casting design, Design process for non metallic parts, Plastics, Rubber, Ceramic, Wood, Glass parts. Material selection in machine design

Employability

Unit –III

Employability

Failure theories: Static failure theories, Distortion energy theory, Maximum shear stress theory, Coulomb-Mohr's theory, Modified Mohr's theory, Fracture mechanics theory., Fatigue mechanisms, Fatigue failure models, Design for fatigue strength and life, creep: Types of stress variation, design for fluctuating stresses, design for limited cycles, multiple stress cycles, Fatigue failure theories ,cumulative fatigue damage, thermal fatigue and shock, harmful and beneficial residual stresses, Yielding and transformation

Employability

Employability

Unit -IV

Surface failures: Surface geometry, mating surfaces, oil film and their effects, design values and procedures, adhesive wear, abrasive wear, corrosion wear, surface fatigue, different contacts, dynamic contact stresses, surface fatigue failures, surface fatigue strength,

Unit -V

Economic factors influencing design: Economic analysis, Break-even analysis, Human engineering considerations, Ergonomics, Design of controls, Design of displays. Value engineering, Material and process selection in value engineering, Modern approaches in design.

Employability

REFERENCE BOOKS:

1. Machine Design An Integrated Approach by Robert L. Norton, Prentice-Hall New Jersey, USA.
2. Mechanical Engineering Design by J.E. Shigley and L.D. Mitchell published by McGraw-Hill International Book Company, New Delhi.
3. Fundamentals of machine elements by Hamrock, Schmid and Jacobian, 2nd edition, McGraw- Hill International edition.
4. Product design and development by Karl T. Ulrich and Steven D. Eppinger. 3rd edition, Tata McGraw Hill.
5. Product Design and Manufacturing by A.K. Chitale and R.C. Gupta, Prentice Hall

I YEAR – I SEMESTER

ELECTIVE-I A

INTEGRATED COMPUTER AIDED DESIGN

Course Code: MECMD115	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

COURSE OBJECTIVES

To make students

- Learn advanced concepts of feature based modeling
- Understand the methods of representation of wireframe, surface, and solid modeling systems.
- Learn role of CAD in MDO (Multidisciplinary Design Optimization).
- Gain extensive hands-on experience with two commercial CAD systems to gain proficiency in using the systems at advanced levels, migrating and sharing data between systems, and applying the theory covered in this course.
- Understand the tools and techniques used to come up with a proper design
- Better communicate their design to an audience

COURSE OUTCOMES:

The students will be able to:

CO1	Develop capacity for creativity and innovation.
CO2	Apply knowledge of basic science and engineering fundamentals
CO3	Utilize systems approach to design and operational performance
CO4	Use appropriate techniques and resources
CO5	Conduct an engineering project

SYLLABUS Employability

UNIT-I

Fundamentals of CAD: Introduction, Design process, Application of computer for design, Creating the manufacturing database, Benefits of CAD, Design work station, CAD hardware.

UNIT-II Employability

Geometric modeling: Geometric modeling techniques - Multiple view 2D input, Wire frame geometry, Surface models, Geometric entities - Curves and Surfaces, Solid modelers, Feature recognition.

Employability

Employability

Computer aided drafting: AutoCAD tools, 3D model building using solid primitives and boolean operations, 3D model building using extrusion, Editing tools, Multiple views: Orthogonal, Isometric.

UNIT-III

Visual realism: Shading solids, Coloring, Color models, Using interface for shading and coloring.

Employability

Graphic aids: Geometric modifiers, Naming scheme, Layers, Grids, Groups, Dragging and rubber banding.

Employability

UNIT-IV

Computer animation: Conventional animation, Computer animation - Entertainment animation, Engineering animation, Animation types, Animation techniques.

Mechanical assembly: Assembly modeling, Part modeling, Mating conditions, Generation of assembling sequences, Precedence diagram, Liaison-sequence analysis.

Employability

UNIT-V

Mechanical tolerancing: Tolerance concepts, Geometric tolerancing, Types of geometric tolerances, Location tolerances, Drafting practices in dimensioning and tolerancing, Tolerance analysis.

Mass property calculations: Geometrical property formulation - Curve length, Cross-sectional area, Surface area, Mass property formulation - Mass, Centroid, Moments of inertia, Property mapping. Properties of composite objects.

Employability

REFERENCE BOOKS:

1. CAD/CAM Theory and Practice by Ibrahim Zeid.
2. CAD/CAM Principles and Applications by P.N. Rao, Tata McGraw Hill Publishing Company Ltd.
3. CAD/CAM Computer Aided Design and Manufacturing by Mikell P. Groover and Emory W. Zimmer, Jr.
4. Computer Integrated Design and Manufacturing by David D. Bedworth, Mark R. Henderson, Philip M. Wolfe.

I YEAR – I SEMESTER

ELECTIVE-I B

PRESSURE VESSEL DESIGN

Course Code: MECMD115

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

To make students:

- Develop an ability to apply knowledge of mathematics, science, and engineering.
- Develop an ability to design a pressure vessel system, component, or process to meet desired needs within realistic constraints.
- Develop an ability to identify, formulate, and solve engineering problems.
- Develop an ability to identify discontinuity stresses in pressure vessels.

COURSE OUTCOMES:

The students will be able to:

CO1	Analyze the stress and strain on cylindrical, spherical and arbitrary shaped shells subjected to internal pressure, wind load bending etc.
CO2	Understand the theory of Rectangular and circular plates subjected to pure bending and different edge conditions.
CO3	Understand the effect of stress concentration influencing various factors such as surface, thermal stress ,fatigue, creep ,hydrogen embrittlement of pressure vessels.

. **SYLLABUS**

Employability

Unit-I

Introduction, Materials- shapes of Vessels –stresses in cylindrical spherical and arbitrary, shaped shells. Cylindrical Vessels subjected to internal pressure, wind load bending and torque-ilation of pressure vessels –conical and tetrahedral vessels.

Theory of thick cylinders; Shrink fit stresses in built up cylinders – auto frettage of thick Cylinders Thermal stresses in Pressure Vessels.

Employability

Unit-II

THEORY OF RECTANGULAR PLATES: Pure bending – different edge conditions.

Theory circular plates: Simple support and clamped ends subjected to concentrated and Uniformly distributed loads-stresses from local loads. Design of dome bends, shell connections, flat heads and cone openings.

DISCONTINUITY STRESSES IN PRESSURE VESSELS: Introduction beam on an elastic

Foundation, infinitely long beam semi infinite beam, cylindrical vessel under axially symmetrical Loading, extent and significance of load deformations on pressure vessels, discontinuity stresses in vessels, stresses in a bimetallic joints, deformation and stresses in flanges.

Unit-III

Pressure vessel materials and their environment: Introduction ductile material tensile tests, Structure and strength of steel Leuder's lines determination of stress patterns from plastic flow Observations, behavior of steel beyond the yield point, effect of cold work or strain hardening on The physical properties of pressure vessel steels fracture types in tension. Toughness of Materials, effect of neutron irradiation of steels, fatigue of metals, fatigue crack growth fatigue life.

Prediction cumulative fatigue damage stress theory of failure of vessels subject to steady state And fatigue conditions.

Employability

Unit-IV

STRESS CONCENTRATIONS: Influence of surface effects on fatigue, effect of the environment

And other factors on fatigue life thermal stress fatigue creep and rupture of metals at elevated Temperatures, hydrogen embitterment of pressure vessel steels brittle fracture effect of Environment on fracture toughness, fracture toughness relationships criteria for design with Defects, significance of fracture mechanics evaluations, effect of warm prestressing on the Ambient temperature toughness of pressure vessel steels.

Employability

Unit-V

DESIGN FEATURES: Localized stresses and their significance, stress concentration at a Variable thickness transition section in a cylindrical vessel, stress concentration about a circular Hole in a plate subject to tension, elliptical openings, stress concentration, stress concentration Factors for position, dynamic and thermal transient conditions, theory of reinforced openings and Reinforcement, placement and shape fatigue and stress concentration.

Employability

REFERENCE BOOKS:

1. Theory and design of modern Pressure Vessels / John F. Harvey 'Van/ Nostrand Reihold Company / New York.
2. Pressure Vessel Design and Analysis / Bickell M. B. Ruizes / Macmillan Publishers
3. Process Equipment design / Beowll & Yound Ett.
4. Indian standard code for unfired Pressure vessels IS 2825.
5. Pressure Vessels Design Hand Book Henry H. Bednar PE / CB S Publishers / New Delhi.
6. Theory of plates and shells / Timoshenko& Noinosky / Dover Publications.
7. Stress in Beams, Plates and Shells / Ansel C. Ugural / CRC Press / 3rd Edition**SIGNAL**

I YEAR – I SEMESTER

ELECTIVE-I C
FATIGUE, CREEP AND FRACTURE MECHANICS

Course Code: MECMD115	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

COURSE OBJECTIVES:

To make students:

- ➢ Develop an ability to apply knowledge of mathematics, science, and engineering.
- ➢ Develop an ability to design a system, component, or process to meet desired needs within realistic constraints
- ➢ Develop an ability to identify the Crack growth in fracture mechanics.
- ➢ Develop an object or component subjected to creep and fluctuating loads.

COURSE OUTCOMES:

The students will be able to:

CO1	Analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts.
CO2	Understand the Crack growth and Energy release rate and establishing a relationship between Crack tip stress and Displacement fields.
CO3	Design the welded structures subjected to fatigue with the use of fracture mechanics to supplement design rules with practical Examples.

. **SYLLABUS**

Employability

UNIT-I

INTRODUCTION: Fracture behaviour of metals and alloys. The ductile/brittle transition temperatures for notched and un-notched components, Ductile rupture as a failure mechanism Fracture at elevated temperature.

Definitions of types of fracture and failure, Introduction to stress intensity factor and strain energy release rate, Equivalence of energy approach and stress intensity approach.

Basic stress analysis and mechanical properties: Elasticity, General 3-D relations, Plane stress and plane strain, Mohr's circle-principal stresses. Yield in materials, Tresca and Von Mises criteria, Ideal and actual strength of materials. Typical stress/strain curves for different classes of materials.

Employability

UNIT-II:

Employability

STRESS INTENSITY FACTOR AND ITS USE IN FRACTURE MECHANICS: Early concepts of stress concentrators and flaws, Ingles solution to stress round an elliptical hole-implications of results. Stress intensity factor for a crack. Westergaard's solution for crack tip stresses. Stresses and displacement in Cartesian and polar coordinates, Linear Elastic Fracture Mechanics, Typical values of fracture toughness, Different modes of crack opening. Superposition of crack tip stress fields, Direction of crack growth under mixed mode loadings. Crack tip plasticity, Early estimates of plastics zone, Irwin plastic zone correction and Dugdale approach, Plastic zone shape in three dimensions and shape under plane stress and plane strain conditions, Allowable plasticity for LEFM to apply, the thickness criterion Experimental methods for measuring Kic.

Employability

UNIT-III:

ELASTIC/PLASTIC FRACTURE MECHANICS: Elastic/plastic fracture mechanics: The crack opening displacement and J-integral approaches, R-curve analysis Testing procedures, Measurement of these parameters, RAD, Fail sage and safe life design approaches, Practical applications. Advanced topics in EOFM.

Employability

Employability

UNIT-IV:

Employability

FATIGUE: Importance of fatigue in engineering, Low cycle fatigue, Coffin-Manson law, Cyclic work hardening and softening. Micro structural models of crack initiation. Stage I, II and III crack growth.

Analysis of Fatigue: The empirical laws of fatigue failure. High cycle-low strain fatigue, Basquin's law, Goodman, Soderberg and Gerber mean stress corrections, Miner's law of damage summation. Low cycle fatigue, Crack growth and application of fracture mechanics to fatigue Paris-Ergodan law, Threshold stress intensity range. Crack closure and its theories Cycle counting methods, Developments in using rain-flow counting methods to recreate fatigue standard spectra. Standard spectra suitable for different applications.

Employability

Employability

UNIT-V:

Employability

FATIGUE OF WELDED STRUCTURES: Factors affecting the fatigue lives of welded joints, the codes and standards available to the designer, the use of fracture mechanics to supplement design rules. Practical examples.

Creep: Phenomenology, Creep curves, Creep properties, Multi-axial creep, Creep-fatigue interaction, Creep integrals.

Employability

REFERENCE BOOKS:

1. Mechanical Metallurgy / Dieter / McGraw Hill
2. Fracture Mechanics: Fundamental and Applications /Anderson T.L & Boca Raton/ CRC Press, Florida, 1998.
3. Deformation and Fracture mechanics of Engineering Materials / Richard W Hertz /Wiley
4. Plasticity for structural Engineers / W.F. Chen and D.J,. Ha,
5. Engineering Fracture Mechanics/ D.R.J. Owen and A.J. Fawkes /Pincridge press, Swansea, U.K.
6. Fracture and fatigue control in structures/ S.T. Rolfe and J.M. Barsom/ Printice Hall, Eglewood cliffs, N.J..
7. Fracture of brittle solids/ B.R. Lawn and T.R. Wilshaw/ Cambridge university press.
8. Plastic deformation of Metals/ R.W.K. Honeycombe/ 2nd edition, Edward

I YEAR – I SEMESTER

ELECTIVE-I D
DATA BASE MANAGEMENT SYSTEMS

Course Code: MECMD115	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

COURSE OBJECTIVES:

- To make students understand the concepts of Data Base Management Systems.

COURSE OUTCOMES:

The students will be able to:

CO 1	Understand the basic concepts and the applications of database systems.
CO 2	Master the basics of SQL and construct queries using SOL.
CO 3	Understand the relational database design principles.
CO 4	Familiar with the basic issues of transaction processing and concurrency control.
CO 5	Familiar with database storage structures and access techniques.

. **SYLLABUS**

UNIT- I

Introduction-Database System Applications, Purpose. of Database Systems, View of Data — Data Abstraction, lnstan.ces and Schemés, Data Models, Database Languages — DDL, DML, Database.Access from Application Programs, Transaction Management, Data”htoragé bnd Querying, Database Architecture, Database Users and Administrators, History of Data base Systems.

Introduction to Data base design, ER diagrams, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprise9.. Relational Model: Introduction to the Relational Model — Integrity Constraints over Relations, Enforcing Integrity consti aints, Querying relational data, Logical data base Design, Introduction to Views — Destroying /altering Tables and Views.

UNIT- II

Relational Algebra and Calculus: Relational Algebra — Selection and Projection, Set operations, Renaming, Joins, Division, Examples of Algebra Queries, Relational calculus — Tuple relational Calculus - Domain relational calculus — Expressive Power of Algebra and calculus.

Form of Basic SQL Oue•y — Examples of Basic SQL Queites, Introduction to Nested Queries, Correlated Nested Queries, Set — Comparison Operators, Aggregate Operators. NULL values — Comparison using Null values — Logical connectives — AND, OR and NOT — Impact on SQL Constructs, Outer Joins, Disallowing NULL values, Complex Integrity Constraints in SQL Triggers and Active Data bases.

UNIT- III

Introduction to Schema Refinement — Problems Caused by redundancy, Decompositions — Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms — FIRST, SECOND, THIRD Normal forms — BCNF —Properties of Decompositions- Loss less- join Decomposition, Dependency preserving Decomposition, Schema Refinement in Data base Design — Multi valued Dependencies — FOURTH Normal Form, Join Dependencies, FIFTH Normal form, Inclusion Dependencies.

UNIT- IV

Transaction Management-Transaction Concept- Transaction State- Implementation of Atomicity and Durability — Concurrent — Executions Serializabil'ity- Recoverability — Implementation of Isolation — Testing for serializability.
Concurrency Control- Lock —Based Protocols — Timestamp Based Protocols- Validation-Based Protocols — Multiple Granularity.
Recovery System-Failure Classification-Storage Structure-Recovery and Atomicity — Log - Based Recovery — Recovery with Concurrent Transactions— Buffer Management — Failure with loss of nonvolatile storage-Advance Recovery systems- Remote Backup systems.

UNIT- V

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing — Clustered Indexes, Primary and Secondary Indexes, Index data Structures — Hash Based Indexing, Tree based Indexing, Comparison of File Organizations.
Tree Structured Indexing: Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM) B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.
Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Exlendible vs. Linear Hashing.

REFERENCE BOOKS:

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TMH, 3rd Edition, 2003.
2. Data base System Concepts, A.SiIberschatz, H.F. Korth, S.Sudarshan, McGraw hill, Vl edition, 2006.
3. Database Systems, 6th edition, Ramez Elmasri, Shamkant B.Navathe, Pearson Education, 2013.
4. Database Principles, Programming, and Performance, P.O'Neil, E.O’NeiI, 2nd ed., ELSEVIER.

I YEAR – I SEMESTER

ELECTIVE-II A

THEORY OF ELASTICITY AND PLASTICITY

Course Code: MECMD116

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To study the classical theory of linear elasticity for two and three dimensional state of stress and obtain solutions for selected problems in rectangular and polar coordinates as well as torsion of prismatic bars.
- To understand the plastic stress strain relations, criteria of yielding and elasto- plastic Problems.

COURSE OUTCOMES:

The students will be able to:

CO 1	Form various equations to study the effect of forces on two dimensional and three dimensional type problems.
CO2	identify the stresses induced in curved bars, rings by considering the stresses induced in the polar coordinate system
CO3	Write down stress-strain and displacement components equations in rectangular and polar coordinate system for various types of problems.
CO4	Understand the concepts of plastic deformation of metals ,Creep.

. **SYLLABUS**

Employability

UNIT-I:

Elasticity: Two dimensional stress analysis - Plane stress - Plane strain - Equations of compatibility - Stress function - Boundary conditions.

Problem in rectangular coordinates - Solution by polynomials - Saint Venent's principles - Determination of displacement - Simple beam problems.

Employability

UNIT-II:

Problems in polar coordinates - General equations in polar coordinates - Stress distribution symmetrical about axis - Strain components in polar coordinates - Simple and symmetric problems.

Employability

Analysis of stress and strain in three dimensions - Principle stresses - Homogeneous deformations - Strain spherical and deviatoric stress - Hydrostatic strain.

Employability

UNIT-III:

General theorems: Differential equations of equilibrium and compatibility - Displacement - Uniqueness of solution - Reciprocal theorem.

Bending of prismatic bars - Stress function - Bending of cantilever beam - Beam of rectangular cross-section - Beams of circular cross-section.

Employability

UNIT-IV:

Plasticity: Plastic deformation of metals - Structure of metals - Deformation - Creep stress relaxation of deformation - Strain rate condition of constant maximum shear stress - Condition of constant strain energy - Approximate equation of plasticity.

Employability

UNIT-V:

Methods of solving practical problems - The characteristic method - Engineering method - Compression of metal under press - Theoretical and experimental data drawing.

REFERENCE BOOKS:

1. Theory of Elasticity by Timoshenko, S.P. and Goodier, J.N.
2. An Engineering Theory of Plasticity by E.P. Unksov.
3. Applied Elasticity by W.T. Wang.
4. Theory of Plasticity by Hoffman and Sacks.

I YEAR – I SEMESTER

ELECTIVE-II B

COMPUTATIONAL METHODS IN ENGINEERING

Course Code: MECMD116

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

➢ To make students familiar with the numerical methods for scientific and engineering computation.

COURSE OUTCOMES:

The students will be able to:

CO1	Discuss several important methods with widespread application for solving large system of equations.
CO2	Appraise the importance of eigen value problems in engineering sciences.
CO3	Analyze experimental data by fitting a polynomial or estimating the derivative or finding the integrals or performing Fourier analysis.
CO4	Prepare mathematical model for physical situations and numerically analyze the corresponding ordinary linear/nonlinear, initial/boundary value differential equations.
CO5	Prepare mathematical model for physical situations and numerically analyze the corresponding partial linear/nonlinear, initial value/ initial boundary value differential equations.

. **SYLLABUS**

Employability

UNIT-I

Linear System of Equations: Gauss elimination method, Triangularization method, Cholesky method, Partition method, Error Analysis for Direct Methods. Iteration Methods: Jacobi Iteration Method, Gauss Seidel Iteration Method, SOR Method

UNIT-II

Eigenvalue and Eigen Vectors, Bounds on Eigen values, Jacobi Method for symmetric Matrices, Givens Method for Symmetric Matrices, Householders Method, Power Method

Employability

UNIT-III

Numerical differentiation: Introduction, Methods based on undetermined coefficients, Optimum choice of step length, Extrapolation Methods, Partial Differentiation Numerical Integration: Introduction, Open type integration rules, Methods based on undetermined coefficients: Gauss-

Employability

Employability

Legendre, Gauss- Chebyshev, Romberg Integration. Double integration: Trapezoidal method, Simpson s method.

Employability

UNIT-IV

Numerical Solutions of Ordinary Differential Equations (Boundary Value Problem): Introduction, Shooting Method: Linear and Non Linear Second order Differential Equations.

UNIT-V

Numerical Solutions of Partial Differential Equations: Introduction, Finite difference Approximation to Derivatives. Laplace equation- Jacobi method, Gauss Seidel Iteration Method, SOR Method. Parabolic Equations, Iterative methods for Parabolic Equations, Hyperbolic equations.

Employability

REFERENCE BOOKS:

1. M.K. Jain, S.R.K. Iyengar and R.K.Jain, "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Limited, Publishers, 4th edition, 2003.

2. S.S. Sastry, "Introductory Methods of Numerical Analysis", Prentice Hall India Pvt., Limited, 4th edition, 2009.

3. Samuel Daniel Conte, Carl W. De Boor, "Elementary Numerical Analysis: An Algorithm Approach", 3rd edition, McGraw-Hill, 2005.

I YEAR – I SEMESTER

ELECTIVE-II C
THEORY OF PLATES AND SHELLS

Course Code: MECMD116

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

To make students:

- Familiar with the concepts allied to Bending of long rectangular plates to a cylindrical surface, Pure bending of plates which consists of small deflections of laterally loaded plates with various edge conditions.
- Familiar with the various views of deformation of shells in the form of a surface of revolution.

COURSE OUTCOMES:

The students will be able to:

CO1	Understand the concepts of bending of plates.
CO2	Design plates and shell for different engineering applications.

. **SYLLABUS**

Unit I:

Bending of long rectangular plates to a cylindrical surface: Differential equation for cylindrical bending of plates - Cylindrical bending of uniformly loaded rectangular plates with simply supported edges - Cylindrical bending of uniformly loaded rectangular plates with built-in edges

Pure bending of plates: Slope and curvature of slightly bent plates - Relations between bending moments and curvature in pure bending of plates - Particular cases of pure bending - Strain energy in pure bending of plates.

EMPLOYABILITY

Unit II:

Symmetrical bending of circular plates: Differential equation for symmetrical bending of laterally loaded circular plates - Uniformly loaded circular plates - Circular plate with a circular hole at the center - Circular plate concentrically loaded - Circular plate loaded at the center.

EMPLOYABILITY

Unit III:

Small deflections of laterally loaded plates: The differential equation of the deflection surface - Boundary conditions - Alternate method of derivation of the boundary condition - Reduction of the problem of bending of a plate to that of deflection of a membrane

EMPLOYABILITY

Unit IV:

Simply supported rectangular plates: Simply supported rectangular plates under sinusoidal load - Navier solution for simply supported rectangular plates.

EMPLOYABILITY

Rectangular plates with various edge conditions: Bending of rectangular plates by moments distributed along the edges - Rectangular plates with two opposite edges simply supported and the other two edges clamped.

Continuous rectangular plates: Simply supported continuous plates - Approximate design of continuous plates with equal spans - Bending symmetrical with respect to a center.

Unit V:

Deformation of shells without bending: Definition and notation - Shells in the form of a surface of revolution and loaded symmetrically with respect to their axis - Particular cases of shells in the form of surfaces of revolution - Shells of constant strength.

General theory of cylindrical shells: A circular cylindrical shell loaded symmetrically with respect to its axis - Particular cases of symmetrical deformation of circular cylindrical shells - Pressure vessels.

EMPLOYABILITY

REFERENCE BOOKS:

1. Theory of Plates and Shells / Timoshenko, S. and Woinowsky-Krieger, S/McGraw Hill

2. Stress in Beams, Plates and Shells / Ansel C. Ugural / CRC Press / 3rd Edition.

I YEAR – I SEMESTER

ELECTIVE-II D
VEHICLE DYNAMICS

Course Code: MECMD116

L	T	P	C
4	0	0	4

COURSE OBJECTIVES

- To make the students understand the intricacies of vehicle dynamics and apply them for road safety and ride comfort.

COURSE OUTCOMES

The student will be able to

CO 1	Understand the mechanisms of pneumatic tyres
CO 2	Understand performance, handling, stability and ride characteristics of road vehicles.

. **SYLLABUS**

UNIT-I:

Introduction to Vehicle Dynamics: Various kinds of vehicles, Motions, Mathematical modelling methods, Multibody system approach, Lagrangian formulations, Methods of investigations, Stability concepts.

EMPLOYABILITY

UNIT-II:

Mechanics of pneumatic tyres: Tyre construction, SAE recommended practice, Tyre forces and moments, Rolling resistance of tyres, Tractive effort and longitudinal slip, Cornering properties of tyres, Performance of tyre traction on dry and wet surfaces, Ride properties of tyres.

EMPLOYABILITY

UNIT-III:

Performance characteristics of road vehicle: Equation of motion and maximum tractive effort, Aerodynamic forces and moments, Vehicle power plant and transmission characteristics, Prediction of vehicle performance, Operating fuel economy, Braking performance.

EMPLOYABILITY

UNIT-IV:

Handling and stability characteristics of road vehicles: Steering geometry, Steady state handling characteristics, Steady state response to steering input, Testing of handling characteristics, Transient response characteristics, Directional stability, Effects of tyre factors, Mass distribution and engine location on stability of handling.

EMPLOYABILITY

UNIT-V:

Vehicle ride characteristics: Human response to vibration, Vehicle ride models, Introduction to random vibration - 1) Road suirface profile as a random function, 2) Frequency response function, 3) Evaluation of vehicle vertical vibration in relation to ride comfort criteria, 4) Active and semi active systems, 5) Optimum design for ride comfort and road holding.

EMPLOYABILITY

REFERENCE BOOKS:

1. Theory of Ground Vehicles by Wong, J.Y., John Wiley and Sons, NY, 1993.
2. Fundamentals of Vehicle Dynamics by Gillespie, T.D., SAE Publication, Warrendal, USA, 1992.
3. Tyres, Suspension and Handling by Dixon, J.C., SAE Publication, Warrendal, USA and Arnold Publication, London, 1997.

I YEAR – I SEMESTER

CAD LAB

Course Code: MECMD117

L	**T**	**P**	**C**
0	**0**	**3**	**2**

COURSE OBJECTIVES:

- To train students in such way that they can prepare Part model, Assembly of parts and obtaining the final production drawing from the assembly.
- To explain basics concepts of 2D drafting using Auto CAD.
- 3D modelling techniques are explained using Autodesk Inventor.
- Model the 3-D geometric information of machine components including assemblies, and automatically generate 2-D production drawings.
- To enhance the students knowledge in presentation and simulation of the assemblies.
- To impart the analysis skills in student by performing various Finite Element Analysis in ANSYS.

COURSE OUTCOMES:

Student will be able to

CO-1	Experiments in the CAD lab will give better knowledge in 2D drafting
CO 2	Students can prepare 3D Models, Assemblies and Drawings
CO 3	Students can solve Analysis problems.
CO 4	Students can do the real time industrial projects in the lab using the available softwares.
CO 5	Students will become industry ready.

. **SYLLABUS**

2D and 3D modeling and assembly modeling using modeling packages like AutoCAD, Auto Desk Mechanical desktop, ProEngineer, IDEAS.

Linear and non-linear static and dynamic analysis using any FEA package ANSYS / CAEFEM / NASTRAN.

Employability

I YEAR – II SEMESTER

MECHANICAL VIBRATIONS

Course Code: MECMD121	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

COURSE OBJECTIVES:

- To make students familiar with the concepts of various types of Mechanical vibrations and apply them in various engineering applications

COURSE OUTCOMES:

The student will be able to

CO 1	Measure various vibration parameters of vibrating systems subjected to longitudinal vibrations with different degrees of freedom
CO 2	Understand the concepts of torsional vibrations
CO 3	Apply the principals of vibration to continuous systems

. **SYLLABUS**

UNIT I

Employability

Single degree freedom systems -Introduction - Single degree freedom systems - free and forced vibrations - Damping classification and damped systems.

UNIT II

Employability

Two degree freedom systems - Free, forced damped and undamped motions - Use of influence coefficients, Matrix methods and Lagrange's equations - Phenomenon of beat - Dynamic absorbers – Applications.

UNIT III

Employability

Employability

Transient (Shock) vibrations as applied to single and two degree freedom systems - Use of mathematics and graphical techniques in the analysis (superposition integral, Laplace transformations, phase plane techniques).

UNIT IV

Multi degree freedom systems - Free and forced motions in longitudinal, torsional and lateral modes - damped and undamped, critical speeds of rotors.

Employability

UNIT V

Employability

Continuous systems:

Free and forced vibrations of string, bars and beams - Principle of orthogonality Classical and energy methods by Rayleigh, Ritz and Gelerkin.

REFERENCE BOOKS:

1. Mechanical Vibrations by A.H. Church.
2. Vibration Problems in Engineering by Timoshenko and Young.
3. Mechanical Vibrations by Den Hartog.
4. Mechanical vibrations by S S Rao
5. Mechanical vibrations by Grover

I YEAR – II SEMESTER

INSTRUMRNTATION & EXPERIMENTAL STRESS ANALYSIS

Course Code: MECMD122

L	T	P	C
4	0	0	4

COURSE OBJECTIVES

1. To give a brief theoretical knowledge related to Instrumentation.
2. The central purpose of this subject is to help students to develop their understanding and ability to apply, both theoretical and experimental stress analysis techniques to real world engineering design tasks.

COURSE OUTCOMES:

The student will be able to:

CO 1	Use the fundamental knowledge in Instrumentation systems.
CO 2	Understand the concepts of Stress Analysis.
CO 3	Use the experimental techniques on the practical problems

. **SYLLABUS**

PART - A (Instrumentation)

Skill development

UNIT-I

Basic concepts: Calibration - Standards - Basic concepts in dynamic measurements – System response - Distortion.

Sensing devices: Bridge circuits - Amplifiers - Filter circuits - Oscilloscope - Oscillograph - Transducers - variable resistance transducers - LVDT - Capacitive and piezoelectric transducers.

Pressure measurement: Mechanical pressure measurement devices - Bourdon tube pressure gauge - Diaphragm and bellow gauges - Low pressure measurement - McLeod gauge – Pirani gauge - Ionization gauge.

Skill development

UNIT-II

Flow measurement: Positive displacement methods - Flow obstruction methods – Flow measurement by drag effect - Hot wire anemometer.

Temperature measurement: Temperature measurements by mechanical effects, Electrical effects and by Radiation - Thermocouples;

Force and Torque measurement; Motion and Vibration measurement.

Skill development

PART - B (Stress Analysis)

UNIT-III

Brittle lacquer method of stress analysis: Application of lacquer - Stress determination - Dynamic stresses; **Grid methods.**

Employability

UNIT-IV

Strain Measurement Methods: Mechanical resistance wire gauges - Types of resistance gauges – Cements and cementing of gauges - Wheatstone bridge - Balanced and unbalanced gauge factor - Calibration of gauges - Strain gauge rosette - Evaluation and principal stresses static and dynamic instrumentation.

Employability

UNIT-V

Photo elasticity: Polariscope - Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials - Isochromatic fringes - Isoclinics - Calibration - Isoclines stress determination.

Employability

REFERENCE BOOKS:

1. Experimental Stress Analysis and Motion Measurement by Dove and Adams.
2. Experimental Methods for Engineers by Holman, J.P., McGraw Hill Book Company.
3. Experimental stress analysis by Dally and Riley, Mc Graw-Hill.
4. Photo Elasticity by Frocht.

I YEAR – II SEMESTER

ADVANCED FINITE ELEMENT ANALYSIS

Course Code: MECMD123

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To introduce students to the basics of theory of elasticity.
- To enable the students understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics and Heat transfer
- To teach students the characteristics of various elements in structural and thermal analysis and selection of suitable elements for the problems being solved.
- To make the students derive finite element equations for different elements.
- To teach students the application of finite element in dynamic analysis and analysis of plates.

COURSE OUTCOMES

The students will be able to:

CO1	Apply the knowledge of Mathematics and Engineering to solve problems in structural mechanics by approximate and numerical methods.
CO2	Solve the problems in solid mechanics and heat transfer using FEM.
CO3	Use commercial FEA packages like ANSYS for solving real life problems.

. **SYLLABUS**

UNIT-I:

Introduction to FEM, basic concepts, historical back ground, applications of FEM, general description, comparison of FEM with other methods, variational approach, Glerkin's Methods. Coordinates, basic element shapes, interpolation function, Virtual energy principle, Rayleigh – Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain-displacement relations.

Employability

Employability

UNIT-II:

1-D STRUCTURAL PROBLEMS: Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions and problems.

ANALYSIS OF TRUSSES, BEAMS & FRAMES: : Plane Trusses and Space Truss elements and problems, Hermite shape functions – stiffness matrix – Load vector – Problems, Plane Frames, Three-Dimensional frames.

Employability

UNIT-III: Employability

2-D PROBLEMS: CST, LST, force terms, Stiffness matrix and load vectors, boundary conditions, Isoparametric elements – quadrilateral element, shape functions – Numerical Integration. Finite element modelling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements. Employability

3-D PROBLEMS: Tetrahedran element, Hexahedral elements – Jacobian matrix – Stiffness matrix.

Employability

UNIT-IV: Employability

SCALAR FIELD PROBLEMS: 1-D Heat conduction-Slabs – Fins - 2-D heat conduction problems Introduction to Torsional problems.

DYNAMIC CONSIDERATIONS: Dynamic equations – consistent mass matrix – Eigen Values, Eigen vector, natural frequencies – mode shapes – modal analysis.

Employability

UNIT-V
Analysis of Plates:
Introduction, Triangular Membrane element, Quadratic Triangle element, Rectangular plate element(in-plane forces), Bending behavior of plates, finite element analysis of plates in bending, triangular plate bending element.
Introduction to FEA packages: ANSYS, SOLID WORKS

REFERENCE BOOKS: Employability

1. Introduction to Finite Elements in Engineering, by Tirupathi R. Chandrupatla, Ashok D.Belegundu. Third edition, Pearson education.
2. Finite element method in engineering by S.S.Rao.
3. Introduction to Finite Element Method, by Abel & Desai.
4. Finite Element Method, by O.C. Zienkiewicz.
5. Concepts and Applications of Finite Element Analysis, by Robert D. Cook.
6. Finite element method by JN Reddy.
7. Finite element method by P.Seshu.

I YEAR – II SEMESTER

ROBOTICS

Course Code: MECMD124

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To be familiar with the automation and brief history of robot and applications.
- To give the student familiarities with the kinematics of robots.
- To give knowledge about robot end effectors and their design.
- To give knowledge about various Sensors and their applications in robots.
- To learn about Robot Programming methods & Languages of robot.

COURSE OUTCOMES:

The students will be able to

CO 1	Define a robot and identify different robotics components.
CO 2	Describe different mechanical configurations of robot manipulators and undertake kinematics analysis of robot manipulators.
CO 3	Understand the importance of robot dynamics
CO 4	Equip with the automation and brief history of robot and applications.
CO 5	Familiar with robot end effectors and their design concepts.
CO 6	Equip with the principles of various Sensors and their applications in robots.
CO 7	Equip with the Programming methods & various Languages of robots.

. **SYLLABUS**

UNIT-I

Employability

Introduction: Transformations and kinematics: Historical development, A sense of mechanisms, Robotic systems, Classification of robots, Position, orientation and location of a rigid body, Mechanics of robot manipulators. Objectives, Homogeneous coordinates, Homogeneous transformations, Coordinate reference frames, some properties of transformation matrices, Homogeneous transformations and the manipulator: The position of the manipulator in space, moving the base of the manipulator via transformations, Moving the tool position and orientation.

Employability

UNIT-II

Position analysis of serial manipulators: Link parameters and link coordinate systems, Denavit-Hartenberg homogeneous transformation matrices, Loop-closure equations, Other coordinate systems, Denavit-Hartenberg method: Position analysis of a planar 3-DOF manipulator: Direct

Employability

kinematics, Inverse kinematics, Method of successive screw displacements, Wrist centre position.

Employability

UNIT-III

Position analysis of parallel manipulators: Structure classification of parallel manipulators, Denavit-Hartenberg method versus geometric method, Position analysis of a planar 3RRR parallel manipulator, Geometry, Inverse kinematics and Direct kinematics, Position analysis of a spatial orientation mechanism.

Employability

UNIT-IV

Jacobian analysis of serial manipulators: Differential kinematics of a rigid body, Differential kinematics of serial manipulators, Screw coordinates and screw systems, Manipulator Jacobian matrix.

Employability

UNIT-V

Trajectory generation: General considerations in path description and generation, Joint space schemes, Cartesian space schemes, Geometric problems with Cartesian paths, Path generation at run time, Description of paths, planning paths using the dynamic model, Collision-free path planning. Robot Programming: Robot languages: AL, AML, RAIL, RPL, VAL, Demonstration of points in space: Continuous path (CP), Via points (VP), Programmed points (PP).

Employability

REFERENCE BOOKS:

1. Robot Analysis - The Mechanics of Serial and Parallel Manipulators by Lung-Wen Tsai, John Wiley & Sons, Inc.

2. Introduction to Robotics - Mechanics and Control by John J. Craig, Addison-Wesley Longman Inc., 1999.

3. Robotic Engineering - An Integrated Approach by Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, Prentice-Hall of India Private Limited, 1994.

I YEAR – II SEMESTER

ELECTIVE-III A
CONCURRENT ENGINEERING

Course Code: MECMD125

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To make the students familiar with the concepts of concurrent engineering and apply them in the industry.

COURSE OUTCOMES:

The students will be able to

CO 1	Understand design principles such as systematic approach to the integrated, concurrent design of products
CO 2	Understand the related processes to concurrent engineering which includes manufacturing and support.
CO 3	Design of automated fabrication systems , Assembly workstation.
CO 4	Enhance their knowledge through various case studies..

. **SYLLABUS**

Unit-I

Introduction: Concurrent design of products and systems - Product design - Fabrication and assembly system design - designing production systems for robustness and structure.

Employability

Unit-II

Strategic approach and technical aspects of product design: Steps in the strategic approach to product design - Comparison to other product design methods - Assembly sequence generation - Choosing a good assembly sequence - Tolerances and their relation to assembly - Design for material handling and part mating - Creation and evaluation of testing strategies.

Employability

Unit –III

Basic issues in manufacturing system design: System design procedure - Design factors - Intangibles - Assembly resource alternatives - Task assignment - Tools and tool changing - Part feeding alternatives - Material handling alternatives - Floor layout and system architecture alternatives.

Assembly workstation design: Strategic issues - Technical issues analysis.

Employability

Employability

Unit –IV

Design of automated fabrication systems: Objectives of modern fabrication system design - System design methodology - Preliminary system feasibility study - Perform detailed work content analysis - Define alternative fabrication configurations - Configuration design and layout - Human resource considerations - Evaluate technical performance of solution.

Employability

Unit –V

Case studies: Automobile air conditioning module - Robot assembly of automobile rear axles.

Employability

REFERENCE BOOK:

1. Concurrent Design of Product and Processes by James L. Nevins and Daniel E. Whitney, McGraw-Hill Publishing Company, 1989.

I YEAR – II SEMESTER

ELECTIVE-III B
MECHATRONICS

Course Code: MECMD125

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To impart the knowledge of integrated design issues in Mechatronics and Mechatronics design process and the basic knowledge of modelling and simulation of block diagrams and also about sensors, transducers, signals and system controls.
- To make students aware of advanced applications in mechatronics.

COURSE OUTCOMES:

The students will be able to:

CO1	Design the mechatronics systems.
CO2	Model and simulate the block diagrams of systems
CO3	Gain knowledge of operation of different sensors and transducers for various applications.
CO4	Gain knowledge in application of Artificial intelligence and micro sensors in mechatronics.

. **SYLLABUS**

UNIT-I

Employability

Mechatronics system design: Introduction to Mechatronics: What is mechatronics, Integrated design issues in mechatronics, Mechatronics key elements, The mechatronics design process, Advanced approaches in mechatronics.

UNIT-II

Modelling and simulation of physical systems: Simulation and block diagrams, Analogies and impedance diagrams, Electrical systems, Mechanical translational systems, Mechanical rotational systems, Electromechanical coupling, Fluid systems.

UNIT-III

Sensors and transducers: An introduction to sensors and transducers, Sensors for motion and position measurement, Force, torque and tactile sensors, Flow sensors, Temperature sensing devices. Actuating devices: Direct current motor, Permanent magnet stepper motor, Fluid power actuation.

Employability

UNIT-IV

Signals, systems and controls: Introduction to signals, systems and controls, System representation, Linearization of nonlinear systems, Time delays.
Real time interfacing: Introduction, Elements of a data acquisition and control system, Overview of the I/O process, Installation of the I/O card and software.

Employability

UNIT-V

Advanced applications in mechatronics: Sensors for condition monitoring, Mechatronic control in automated manufacturing, Artificial intelligence in mechatronics, Microsensors in mechatronics.

Employability

Employability

REFERENCE BOOKS:

1. Mechatronics System Design by Devdas Shetty and Richard A. Kolk, P.W.S. Publishing Company, 2001.
2. Mechatronics by W. Bolton, Pearson Education, Asia, II-Edition, 2001.

I YEAR – II SEMESTER

ELECTIVE-III C
COMPUTATIONAL FLUID DYNAMICS

Course Code: MECMD125

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To introduce students to the governing equations of Fluid dynamics and the application of finite difference method for solving partial differential equations.
- The objective is also to equip them to solve incompressible viscous flows, compressible flows, steady state, transient, two dimensional and three dimensional problems.

COURSE OUTCOMES:

The students will be able to:

CO1	Understand the basic concept of fluid dynamics, solution methods & apply it to real time problems to develop mathematical model.
CO2	Solve problems related to Incompressible viscous flows, compressible flows, steady state and transient analysis.
CO3	Apply finite volume method to solve two and three-dimensional problems.

. **SYLLABUS**

Employability

UNIT-I:

Introduction: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions. Derivation of finite difference equations.

Solution methods: Solution methods of elliptical equations - finite difference formulations, interactive solution methods, direct method with Gaussian elimination.Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

UNIT-II: Employability

Hyperbolic equations: explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations.Burgers equations: Explicit and implicit schemes, Runge-Kutta method.

Employability

UNIT-III:

Formulations of incompressible viscous flows: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Treatment of compressible flows: potential equation, Eluer equations, Navier-stokes system of equations, flowfield-dependent variation methods, boundary conditions, example problems.

Employability

UNIT-IV:

Finite volume method: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

Employability

UNIT-V:

Standard variational methods - 1: Linear fluid flow problems, steady state problems,

Standard variational methods - 2: Transient problems.

Employability

REFERENCE BOOKS:

1. Computational fluid dynamics, T. J.Chung, Cambridge University press, 2002.
2. Text book of fluid dynamics, Frank Chorlton, CBS Publishers & distributors, 1985.
3. D.A. Hoffmann & S.T. Chiang, “Computational Fluid Dynamics”, Volume-I, II&III, A publication of Engineering Education SystemTM, Wichita, Kansas, USA.

I YEAR – II SEMESTER

ELECTIVE-IV B

QUALITY CONCEPTS IN DESIGN

Course Code: MECMD126	L	T	P	C
	4	0	0	4

COURSE OBJECTIVES:

To impart knowledge on various concepts in engineering design and principles of implementing quality in a product or service through tools such as quality houses, control charts, statistical process control method, failure mode effect analysis and various strategies of designing experiments, methods to uphold the status of six sigma and improve the reliability of a product.

COURSE OUTCOME:

The students will be able to:

CO 1	Get familiarize with various concepts in design, quality and reliability principles in the design of an engineering product or a service.

. **SYLLABUS**

UNIT I

DESIGN FUNDAMENTALS, METHODS AND MATERIAL SELECTION

Morphology of Design – The Design Process – Computer Aided Engineering – Concurrent Engineering – Competition Bench Marking – Creativity – Theory of Problem solving (TRIZ) – Value Analysis - Design for Manufacture, Design for Assembly – Design for casting, Forging, Metal Forming, Machining and Welding

UNIT II

DESIGN FOR QUALITY

Quality Function Deployment -House of Quality-Objectives and functions-Targets-Stakeholders-Measures and Matrices-Design of Experiments –design process-Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design – testing noise factors- Running the experiments –Conducting the analysis-Selecting and conforming factor-Set points-reflecting and repeating.

Employability

UNIT III

FAILURE MODE EFFECT ANALYSIS AND DESIGN FOR SIX SIGMA

Basic methods: Refining geometry and layout, general process of product embodiment - Embodiment checklist- Advanced methods: systems modeling, mechanical embodiment principles-FMEA method- linking fault states to systems modeling - Basis of SIX SIGMA – Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production –Lean SIX SIGMA and services

Employability

UNIT IV

DESIGN OF EXPERIMENTS

Importance of Experiments, Experimental Strategies, Basic principles of Design, Terminology, ANOVA, Steps in Experimentation, Sample size, Single Factor experiments - Completely Randomized design, Randomized Block design, Statistical Analysis, Multifactor experiments - Two and three factor full Factorial experiments, 2 K factorial Experiments, Confounding and Blocking designs, Fractional factorial design, Taguchi's approach - Steps in experimentation, Design using Orthogonal Arrays, Data Analysis, Robust Design- Control and Noise factors, S/N ratios

Employability

UNIT V

STATISTICAL CONSIDERATION AND RELIABILITY

Frequency distributions and Histograms- Run charts –stem and leaf plots- Pareto diagrams-Cause and Effect diagrams-Box plots- Probability distribution-Statistical Process control–Scatter diagrams –Multivariable charts –Matrix plots and 3-D plots.-Reliability-Survival and Failure-Series and parallel systems-Mean time between failure-Weibull distribution

Employability

REFERENCE BOOKS:

1. Dieter, George E., "Engineering Design - A Materials and Processing Approach", McGraw Hill, International Editions, Singapore, 2000.
2. Product Design Techniques in Reverse Engineering and New Product Development, KEVIN OTTO & KRISTIN WOOD, Pearson Education (LPE), 2001.
3. Product Design And Development, KARL T. ULRICH, STEVEN D. EPPINGER, TATA McGRAW-HILL- 3 rd Edition, 2003.
4. The Management and control of Quality-6 th edition-James R. Evens, William M Lindsay Pub:son south-western(www.swlearning.com)
5. Fundamentals of Quality control and improvement 2nd edition, AMITAVA MITRA, Pearson Education Asia, 2002.
6. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, 2003.
7. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.

I YEAR – II SEMESTER

ELECTIVE-IV C
SIGNAL ANALYSIS AND CONDITION MONITORING

Course Code: MECMD126

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

To make the student Understand

- The use of advanced instrumentation and sensing methods.
- System integration.
- Apply signal processing methods and system design methods.
- Introduce condition monitoring procedures.

COURSE OUTCOMES:

The students will be able to:

CO1	Apply signal-processing methods, the principles of instrumentation and measurement systems.
CO2	Perform practical analysis on actual machines and systems, Develop a maintenance strategy based on system response.
CO3	Understand the advantages and limitations of a variety of techniques for condition monitoring.
CO4	Understand the environmental benefits of condition monitoring techniques, Condition monitoring approaches, sensor types, sensor placement, data analysis.

. **SYLLABUS**

UNIT-I

INTRODUCTION: Basic concepts, Fourier analysis, Bandwidth, Signal types, Convolution.

SIGNAL ANALYSIS: Filter response time, Detectors, Recorders, Analog analyzer types.

Employability

UNIT-II

PRACTICAL ANALYSIS OF STATIONARY SIGNALS:
Stepped filter analysis. Swept filter analysis. High speed analysis, Real-time analysis.

Employability

UNIT-III

PRACTICAL ANALYSIS OF CONTINUOUS NON-STATIONARY SIGNALS: Choice of window type, Choice of window length, Choice of incremental step, Practical details, Scaling of the results.

Employability

UNIT-IV

PRACTICAL ANALYSIS OF TRANSIENTS: Analysis as a periodic signal, Analysis by repeated playback (constant bandwidth), Analysis by repeated playback (variable bandwidth)

UNIT-V

CONDITION MONITORING IN REAL SYSTEMS: Diagnostic tools, Condition monitoring of two stage compressor, Cement mill foundation, I.D. fan, Sugar centrifugal, Cooling tower fan, Air separator. Preheater fan, Field balancing of rotors. ISO standards on vibrations.

Employability

REFERENCE BOOKS:

1. Condition Monitoring of Mechanical Systems by Kolacat.
2. Frequency Analysis by R.B.Randall.
3. Mechanical Vibrations Practice with Basic Theory by V. Ramamurti, Narosa Publishing House.

I YEAR – II SEMESTER

ELECTIVE-IV D
COMPOSITE MATERIALS

Course Code: MECMD126	**L**	**T**	**P**	**C**
	4	**0**	**0**	**4**

COURSE OBJECTIVES:

- To understand the fundamentals of composite material strength and its mechanical behavior
- Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
- Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

COURSE OUTCOMES:

The students will be able to:

CO 1	Understand the mechanics and design related to layered components such as fiber reinforced polymer composites, isotropic layered structures (example electronic chips) etc and its manufacturing methodologies.

. **SYLLABUS**

UNIT I

INTRODUCTION TO COMPOSITE MATERIALS

Definition-Matrix materials-polymers-metals-ceramics - Reinforcements: Particles, whiskers, inorganic fibers, metal filaments- ceramic fibers- fiber fabrication- natural composite wood, Jute - Advantages and drawbacks of composites over monolithic materials. Mechanical properties and applications of composites, Particulate-Reinforced composite Materials, Dispersion-Strengthened composite, Fiber-reinforced composites Rule of mixtures-Characteristics of fiber-Reinforced composites, Manufacturing fiber and composites.

Employability

Employability

UNIT II

MANUFACTURING OF COMPOSITES

Manufacturing of Polymer Matrix Composites (PMCs)-handlay-up, spray technique, filament winding, Pultrusion, Resin Transfer Moulding (RTM)-, bag moulding, injection moulding,

Employability

Sandwich 15 Mould Composites (SMC) - Manufacturing of Metal Matrix Composites (MMCs) - Solid state, liquid state,vapour state processing, Manufacturing of Ceramic Matrix Composites (CMCs) –hot pressing-reaction bonding process-infiltration technique, direct oxidation- interfaces.

UNIT III

Employability

INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS

Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT IV

LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

Employability

UNIT V

THERMAL ANALYSIS

Assumption of Constant Co-efficient of Thermal Expansion (C.T.E.) - Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates.

Employability

REFERENCE BOOKS:

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994, Second Edition - CRC press in progress.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, 1998

3. Issac M. Daniel and Ori Ishai, “Engineering Mechanics of Composite Materials”, Oxford University Press-2006, First Indian Edition - 2007
4. Mallick, P.K., Fiber –”Reinforced Composites: Materials, Manufacturing and Design”, Maneel Dekker Inc, 1993.
5. Halpin, J.C., “Primer on Composite Materials, Analysis”, Techomic Publishing Co., 1984.
6. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber Composites”, John Wiley and Sons, New York, 1990.
7. Mallick, P.K. and Newman, S., (edition), “Composite Materials Technology: Processes and Properties”, Hansen Publisher, Munish, 1990.
8. Madhujit Mukhopadhyay, “Mechanics of Composite Materials and Structures”, University Press (India) Pvt. Ltd., Hyderabad, 2004 (Reprinted 2008)
9. Chung, Deborah D.L., “Composite Materials: Science and Applications”, Ane Books Pvt. Ltd./Springer, New Delhi, 1st Indian Reprint, 2009

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
M.Tech. (Communication Systems), Two year (Four Semester) Syllabus Scheme

SEMESTER – I

CODE	SUBJECT NAME	Instruction periods per Week				MAX MARKS		CREDITS
		LECTURE	TUTORIAL	PRACTICAL	TOTAL	SESSIONAL MARKS	SEMESTER END MARKS	
MTCS-1	Advanced Digital signal processing	4	1	-	5	40	60	4
MTCS-2	Digital Communication Techniques	4	1	-	5	40	60	4
MTCS-3	Satellite Communication and Phased arrays	4	1	-	5	40	60	4
MTCS-4	Optical Fiber Communications	4	1	-	5	40	60	4
MTCS-5	Core Elective –I	4	1	-	5	40	60	4
MTCS-6	Core Elective-II	4	1	-	5	40	60	4
MTCS-7	Communication Engineering Lab	-	-	3	3	50	50	2
MTCS-8	Seminar - I	-	-	2	2	100	-	2
	Total	24	6	5	35	390	410	28

Core Elective – I
a) Global Positioning System
b) Micro Controllers and Embedded Systems
c) Smart Antennas

Core Elective-II
a) Telecommunication Switching and Networks
b) Spread Spectrum Techniques & Multiple Access
c) Speech Signal Processing

SEMESTER – II

CODE	**SUBJECT NAME**	Instruction periods per Week				MAX MARKS		CREDITS
		LECTURE	TUTORIAL	PRACTICAL	TOTAL	SESSIONAL MARKS	SEMESTER END MARKS	
MTCS-9	Communication Networks	4	1	-	5	40	60	4
MTCS-10	Wireless Communications	4	1	-	5	40	60	4
MTCS-11	Multimedia and Communication Systems	4	1	-	5	40	60	4
MTCS-12	Elective - III	4	1	-	5	40	60	4
MTCS-13	Elective – IV	4	1	-	5	40	60	4
MTCS-	Elective – V	4	1	-	5	40	60	4

14								
MTCS-15	Signal Processing Lab	-	-	3	3	50	50	2
MTCS-16	Seminar - II	-	-	2	2	100	-	2
	Total	24	6	5	35	390	410	28

Core Elective-III
a) Software Defined Radio
b) Modern Radar Systems
c) Digital Image Processing

Core Elective- IV
a) RF and Microwave Engineering
b) Wavelet transforms and Its Applications
c) Modeling and Simulation of Communication Systems

Core Elective -V
a) Statistical Signal Processing
b) CPLD and FPGA Architecture and Applications
c) AD-HOC Networks

SEMESTER – III

CODE	**SUBJECT NAME**	*MAX MARKS*		CREDITS
		SESSIONAL MARKS	*SEMESTER END MARKS*	
MTCS – 17	MOOC	100	-	4
MTCS – 18	Thesis (Part I)	50	50	6
Total		150	50	10

Project work to be submitted before the end of 3rd Semester and it will be evaluated by a committee consisting of Chairman, Board of Studies, Head of the Department and thesis guide.

SEMESTER – IV

CODE	**SUBJECT NAME**	*MAX MARKS*		CREDITS
		SESSIONAL MARKS	*SEMESTER END MARKS*	
MTCS – 19	Thesis (Part II)	50	50	14

Semester –IV project work will begin after completion of semester-III examination.
Thesis work is for a period of SIX months in Industry/Department. The students are required to submit their thesis two/three phases. Thesis will be evaluated by a committee consisting of an external member from reputed institution, HOD, Chairman BOS and thesis Guide.

MTCS-1 ADVANCED DIGITAL SIGNAL PROCESSING

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Pre-requisites: Prior to this, an apt knowledge of signal & systems and digital signal processsing subjects should be known.

Course Objectives:

At the end of this course, the students will be able to understand the:

a) Various optimization techniques used in designing the digital filters.
b) Sampling rate requirement in the digital signal applications
c) Need for prediction, filtering & smoothening of the signals to minimize the mean-square error(MSE).
d) Different DSP algorithms used for DFT computation procedures.
e) Applications of DSP in real time.

Unit– I: Advanced digital filter design techniques: Design of optimum equi-ripple FIR filters, Remez Algorithm, Parks-McClellan Algorithm, Differentiators, BPF, Hilbert transformer filters multiple band optimal FIR filters, Design of filters with simultaneous constraints in time and frequency response, Optimization methods for designing IIR filters, Comparison of optimum FIR filters and delay equalized elliptic filters. **(12hrs)**

Unit – II: Multirate DSP: The basic sample rate alteration – time – domain characterization, frequency – domain characterization: Cascade equivalences, filters in sampling rate alteration systems, digital filter banks and their analysis and applications, Multi-level filter banks.**(10hrs)**

Unit – III: Linear prediction and optimum linear filters: forward and backward linear prediction, AR Lattice and ARMA lattice – ladder filters, Wieners filters for filtering on prediction. **(7hrs)**

Employability

Unit – IV: DSP Algorithms: Levinson – Durbin algorithm, the Schur algorithm, The Goertzel algorithm, the chirp – z transform algorithm, Bluestein algorithm, computations of the DFT, concept of tunable digital filters. **(8hrs)**

Unit – V: Applications of DSP: Speech Model of speech production, speech analysis – synthesis system vocoder analyzers and synthesizers, convolvers,Linear Prediction of speech, DTMF System, DTTR, MUSIC, TDM to FDM translator. **(8hrs)**

Employability

Course Outcomes:

a) Using filter optimization techniques students will be able to design a filter with Least Mean Square error.(UNIT-I)
b) Students will be able to solve research papers related to multirate signal processing— Data Acquisition, Bandwidth reduction in a system etc. (UNIT-II)
c) Apply methods for prediction of real world signals, based on signal modeling and advanced filtering techniques, such as Linear Predictive Filters and Optimal Linear Filters.(UNIT-I,III,V)
d) Apply fundamental principles, methodologies and techniques of the course to analyze and design various problems encountered in both academic research ,industry and R&D practice. (UNIT-IV)
e) This course is basis for understanding Adaptive signal processing, statistical signal processing and wavelet transform subjects.

employability

Prescribed Text Books:

1. Lawrence R. Rabiner and Bernard Gold ,"Theory and applications of digital signal processing" PHI,4th edition.**(UNIT 1,5)**
2. J. G. Proakis and D. G. Manolakis, Introduction to Digital Signal Processing, 4td Edition. Prentice Hall, 1996, ISBN No. 0-13-373762-4. **(UNIT 2,3 4)**

References:

1. Multi Rate Systems and Filter Banks – P.P.Vaidyanathan – Prentice Hall,1st edition
2. DSP – A Practical Approach – Emmanuel C. Ifeacher, Barrie. W. Jervis, 2nd Ed., Prentice Hall.
3. Sanjit K. Mitra,"Digital Signal Processing, A Computer – Based approach,Tata Mc Graw-Hill, 1998,$th edition **(UNIT 2)**

MTCS2- DIGITAL COMMUNICATION TECHNIQUES

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Course Objectives

1. To enable student to Design a channel coder for different channels for obtaining optimum error probablitiy.

2. To enable student to analyze the synchronizing circuits for different modulation schemes.

3. To familiarize Student with the concepts of spread spectrum and jammer considerations

UNIT – I

DIGITAL MODULATION SCHEMES: Detection using matched filter – Optimum receivers for arbitrary binary signals and M'ary orthogonal signals – Analysis of coherent detection schemes for ASK, PSK and DPSK – M'ary signaling schemes – QPSK and QAM – MSK – Performance of the data transmission schemes under AWGN. Trellis coded Modulation.

UNIT – II

CHANNEL CODING: Waveform coding and structured sequences-Types of error control, structured sequences, Linear block codes –soft/hard decision decoding of linear block codes – Non binary block codes and concatenated block codes – Polynomial representation of codes – Cyclic codes

Employability

UNIT – III

CHANNEL CODING-II: Convolution codes Lattice type Trellis codes. Geometrically uniform trellis codes,– viterbi decoding algorithm. Decoding of modulation codes – Reed Solomon codes – Turbo codes(elementary treatment).

BASEBAND SIGNALLING CONCEPTS:

Signaling formats – RZ/NRZ, Duobinarysplitphase (Manchester) and high density bipolar coding – scrambling & unscrambling – channel equalization – tapped delay line and transversal filters.

Employability

UNIT – IV

SYNCHRONISATION: Receiver synchronization, costas loop, symbol synchronization, synchronization with CPM – Data aided and Non aided synchronization- synchronization methods based on properties of wide sense

cyclo-stationary random process – Carrier recovery circuits – Symbol clock estimation schemes.

UNIT – V
SPREAD SPECTRUM SYSTEMS: PN sequences, DS spread spectrum systems; FH spread spectrum systems and performance of FHSS in AWGN – Synchronization – Jamming considerations – Commercial Applications – Cellular subsystems.

Course Outcomes
After completion of this Course Student will be able to:
1. Simulate a digital communication System.
2. Design Linear Block coder with different Error correction capabilities.
3. Design a Convolution coder to obtain specific error probabilities.
4. Simulate different channel encoders.
5. Design a Synchronizing circuit for any digital modulation scheme under specified error rate.
6. Analyze the jamming to signal noise ratio for a jammer.

PRESCRIBED :
1. Bernard sklar, " Digital communications", Pearson Education Asia,2001.
2.Fundamentals of Communication Systems, Proakis and Salehi, Prentice Hall

REFERENCES:
1.Das,J Etal, " Principles of Digital Communications and Spread spectrum Systems", Willey Eastern Limited,1985.
2.Ziemer R E & Peterson R L, "Digital Communication and Spread spectrum Systems", McMillan publishing co.,1985.

MTCS 3- SATELLITE COMMUNICATION AND PHASED ARRAYS

Course code	Credits	Periods			Exam Hours	Sessional Marks	Exam Marks	Total Marks
		Lectures	Tutorials	Practicals				
MTCS-3	4	3	1	-	3	40	60	100

Course Objectives:
1. To learn about the science behind the orbiting satellites, various multiplexing schemes and earth station parameters used for satellite communication.
2. In-depth understanding of specialist bodies of knowledge within the engineering discipline.
3. Application of established engineering methods to complex engineering problem solving.

Unit 1: **Orbits, Propagation impairments and space link:**
Introduction, Satellite orbits, Kepler's three laws, Orbital Elements, Eclipse effect, Orbit determination, Look angle determination. Satellite sub systems: Attitude and Orbital Control System (AOCS), Telemetry Tracking and Command (TT&C), Power System, Communications System, Satellite transponder, Space Craft Antennas, Frequency Reuse Antennas. Communication link design: Basic transmission theory, EIRP, Completion Link design with and without frequency reuse, System noise temperature G/T ratio, Noise figure and Noise temperature.
Unit 2: **Satellite Multiple Accesses: Satellite mobile and specialized services**
Frequency Division Multiple Access (FDMA),Intermodulation, Calculation of C/N, Time Division Multiple Access (TDMA),Satellite Switched TDMA, Demand Assignment Multiple Access (DAMA), CDMA Spread Spectrum Transmission and Reception.

Message Transmission by FDMA: M/G/1 Queue, Message Transmission by TDMA, PURE ALOHA, Satellite Packet Switching, Slotted Aloha, Packet Reservation, Tree Algorithm, VSAT Technologies, Network Configurations, Polling VSAT Networks, Mobile Satellite Networks, CDMA MSAT Network.

Unit 3: **Earth Station Technology**:

Transmitters, Receivers, Antennas, Tracking Systems, Transponders, Small earth station Antennas, Equipment for earth station, Lower Orbit Considerations, Coverage and frequency considerations, Direct broadcasting satellite Television and Radio, Satellite Navigation.

Employability

Unit 4**: Introduction of Phased Arrays**

System Requirements for Radar and Communication Antennas : Directive Properties of Arrays, Array Noise Characterization, The Receiving Antenna in a Polarized Plane Wave Field, System Considerations, Monopulse Beam Splitting.

Unit 5: **Phased Arrays in Radar and Communication Systems**:

Array Characterization for Radar and Communication Systems and Fundamental Results from Array Theory: Phase Scanning in One Dimension ($\phi_0=0$), Two-Dimensional Scanning of Planar Arrays, Beam width and Directivity of Scanning Arrays, Array Size Determination: EIRP and G/T for Large, Two-Dimensional Passive or Active Arrays.

Employability

Course Outcomes:

On successful completion of this course, the student will be able to:

CO1: Architect appropriate technologies for implementation of specified satellite communication systems based on specify systems design for satellite communications

CO2: Analyze and evaluate a satellite link and suggest enhancements to improve the link performance

CO3: Exercise the following skills: project management, teamwork and leadership, technical communication, and self-directed and group learning.

CO4: Conduct further research on satellite communication systems engineering & on phased array antennas as per given specifications.

TEXT BOOKS:

1. Satellite Communications –Timothy Pratt, Charles Bostian, Jeremy Allnutt, 2nd Edition, 2003, John Wiley & Sons.
2. Digital Satellite Communications-Tri.T.Ha, 2nd Edition, 1990, Mc.Graw Hill.
3. Phased Array Antenna Hand Book – Robert J. Mailloux, Artech House, Boston, London, 1994.

REFERENCE BOOKS:

1. Satellite Communications - by Dr.D.C.Agarwal
2. Satellite Communications: Design Principles – M. Richcharia, 2nd Ed., BSP, 2003.
3. Fundamentals of Satellite Communications – K. N. Raja Rao, PHI, 2004.

MTCS-4 OPTICAL FIBER COMMUNICATIONS

Credits	**Instruction periods per Week**			**Exam Hrs.**	**SESSIONAL MARKS**	**SEMESTER END MARKS**	**Total Marks**
	LECTURE	**TUTORIAL**	**PRACTICAL**				
4	**4**	**1**	**-**	**3**	**40**	**60**	**100**

Course Objectives:

1. To expose the students to the modulation formats used in fiber optic communications
2. To impart the understanding and modeling of optical amplifiers
3. To understand the various multiplexing schemes
4. To understand the working of optical networks
5. To understand the nonlinear effects of optical communication systems

UNIT-I

Advanced Modulation Formats for Fiber Optic Communication Systems: Fiber Optic Coupler,
Coherent Optical Communication, BER performance, Differential Phase Modulation Schemes with Direct Detection

Employability

UNIT-II

Semiconductor optical amplifiers. EDFA and Raman amplifiers , Wideband Optical amplifiers, Amplifier Noise, Optical SNR, modeling and analysis. Analysis and digital transmission with high power fiber amplifiers

Employability

UNIT-III

Multichannel systems: WDM lightwave systems. TDM and code division multiplexing. Advances in wavelength division multiplexing / demultiplexing technologies

Employability

UNIT-IV

SONET/SDH, ATM, IP, storage area networks, Wavelength routed networks, Next generation optical Internets

Employability

UNIT-V

Soliton systems: Nonlinear effects. Soliton – based communication. High speed and WDM soliton systems

Employability

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Compare the performances of modulation formats used in optical communications
2. Model and use optical amplifiers
3. Understand and apply the multiplexing technologies
4. Understand the operation of, and trends in, optical networks.
5. Exploit the nonlinear effects of fibers in Soliton based communications.

Text Books:

1.G.P.Agrawal, Fiber Optic Communication Systems (3/e), Wiley, 2002
2.M.Satish Kumar, Fundamentals of Optical Fiber Communication(2/e), PHI, 2014
3.C.S.Murthy & M.Gurusamy, WDM Optical Networks, PHI, 2002

References:

1.Gerd Keiser, Optical Fiber Communications(4/e), TMH, 2008
2.B.P.Pal , Guided Wave Optical Components and Devices, Elsevier , 2006
3.Keang P. Ho Phase-modulated Optical Communication Systems, Springer, 2005

MTCS-5 GLOBAL POSITIONING SYSTEM AND APPLICATIONS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

COURSE OBJECTIVES:

1. To enable student to understand the basic principle of GPS
2. To enable student to understand the difference between GPS, GALILEO and GLONASS
3. To familiarize the student with the concepts of different co-ordinates system used in GPS
4. To enable student to know about the effect of ionosphere and troposphere on GPS position determination

UNIT I

Introduction to GPS: Basic concept, system architecture, space segment, user segment, GPS aided Geo-augmented navigation (GAGAN) architecture.

UNIT II

GPS Signals: Signal structure, anti spoofing (AS), selective availability, Difference between GPS, GALILEO and GLONASS satellite construction, GPS Receiver Concepts and main receiver components.

UNIT III

GPS coordinate frames & Time references: Geoid and Ellipsoid of rotation, Geodetic and Geo centric coordinate systems, ECEF coordinate world geodetic 1984 (WGS 84), GPS & GALILEO time.

UNIT IV

GPS orbits and position determination: GPS orbital parameters, GPS position determination, Positioning methods- point positioning, relative positioning, and description of receiver independent exchange format (RINEX).

UNIT V

GPS Errors & Future of GPS: GPS error sources- clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver, DGPS concepts, Future of GPS- Modernization plans of navigational satellites, Hardware and software improvements.

COURSE OUT COMES:

After learning this subject student can be able to

1. Understand basic concepts of GPS and its architecture (unit-1)
2. Describe the signal structure and can differentiate GPS &GALILEO time (unit-2)
3. Convert one co-ordinate frame into another (unit-3)
4. Determine the GPS user position (unit-4)
5. Calculate different error's in GPS and can design the system in GPS and can design the system with improved accuracy (unit-5)

PRESCRIBED :

1. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, 'GPS – Theory and Practice', Springer – Wien, New York (2001).
2. G S RAO, Global Navigation Satellite Systems, McGraw-Hill publications, New Delhi, 2010

REFERENCES:

1. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).
2. Gunter Seeber., Satellite Geodesy Foundations-Methods and Applications,2003.

MTCS-5b MICROCONTROLLERS & EMBEDDED SYSTEMS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Course Objectives

a. To provide a theoretical & practical introduction to microcontrollers

b. To assembly language programming techniques,

c. To design interfacing circuits for microcontroller 8051.

d. To develop an understanding of the technologies behind the embedded computing systems

e. To understand the technology capabilities and limitations of the hardware, software components

f. To evaluate design tradeoffs between different technology choices.

UNIT I: **8051 Microcontroller**

Introduction to Microcontrollers, comparing Microprocessors and Microcontrollers, Architecture of 8051 Micro controller, Register organization of 8051, SFRs, Addressing modes of 8051,.

Pin configuration of 8051, Input/Output Ports and Circuits, External Memory, Counters/Timers and modes of Timers, Serial data Input/Output, Interrupts.

UNIT II: **Assembly Language Programming of 8051**

Programming the 8051. Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions.

UNIT III: **Interfacing 8051**

Interfacing with Keyboards, Displays, D/A and A/D conversions, Multiple Interrupts, Serial Data Communication.

Skill development/Employability

UNIT IV: **Introduction To Embedded Systems**
Embedded systems overview, design challenge, Processor technology, IC technology, Design Technology, Trade-offs.

UNIT V: **Introduction to advanced architectures**
ARM and SHARC, Processor and memory organization and Instruction level parallelism;
Networked embedded systems: Bus protocols, I2C bus and CAN bus;
Internet-Enabled Systems, Design Example-Elevator Controller.

Skill development/Employability

COURSE OUTCOMES

Upon successful completion of the course, students will be able to:

1. Explain the architecture and operation of microcontrollers - 8051, ARM and SHARC.

2. Interface 8051 with various peripherals

3. Understand the hardware/software tradeoffs involved in the design of microcontrollers based systems.

4. Understand the hardware/software tradeoffs involved in the design of embedded systems.

5. Use an Integrated Development Environment (IDE) as a modern software tool for embedded system development.

TEXT BOOKS:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D Mc Kinlay , The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2nd Edition, Pearson Education, 2008.
2. Frank Vahid, Tony Givargis, Embedded System Design, 2nd Edition, John Wiley.
3. Wayne Wolf, Computers as Components-principles of Embedded computer system design, Elsevier

REFERENCE BOOKS:

1. Kenneth. J. Ayala, Dhananjay V. Gadre, The8051 Microcontroller & Embedded Systems Using Assembly and C, 1st edition, Cengage learning, 2010
2. David E. Simon, An Embedded Software Primer, Pearson Education
3. Satish Shah, 8051 Microcontrollers: MCS 51 Family and Its Variants, 1/e, Oxford University Press, 2010
4. B. Kanta Rao, Embedded Systems, 1st Ed., PHI, 2011

MTCS-5C SMART ANTENNAS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Course objectives:

The course helps the students

1. To understand basic concepts of cellular mobile systems.
2. To understand the concept of smart antennas and adaptive algorithms to adjust the required weighting on antennas.
3. To learn Modeling, spatial processing, techniques for CDMA system and RF positioning for the smart antennas.

Module I

Introduction To Smart Antennas Need for Smart Antennas, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Mutual Coupling Effects.

Module II

DOA Estimation Fundamentals Introduction The Array Response Vector, Received Signal Model, The Subspace Based Data Model, Signal Auto covariance Matrices ,Conventional DOA Estimation Methods, Conventional Beam forming Method, Capon's Minimum Variance Method, Subspace Approach to DOA Estimation ,The MUSIC Algorithm, The ESPRIT Algorithm, Uniqueness of DOA Estimates.

Skill Development

Module III

Beam forming Fundamentals The Classical Beam former-Statistically Optimum Beam forming Weight Vectors, The Maximum SNR Beam former, The Multiple Side lobe Canceller and the Maximum, SINR Beam former- Minimum Mean Square Error (MMSE),Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV) , Adaptive Algorithms for Beam forming ,The Least Mean-Square (LMS) Algorithm, The Recursive Least Squares (RLS) Algorithm.

Module IV

Space–Time Processing Introduction, Discrete Space–Time Channel and Signal Models, Space–Time Beam forming, Inter symbol and Co-Channel Suppression, ISI Suppression, CCI Suppression, Joint ISI and CCI Suppression, Space–Time Processing for DS-CDMA, Capacity and Data Rates in MIMO Systems, Single-User Data Rate

Skill Development

Limits, Multiple Users Data Rate Limits, Data Rate Limits Within a Cellular System, MIMO in Wireless Local Area Networks.

Module V

Mobile Stations' Smart Antennas Introduction -Multiple-Antenna MS Design, Combining Techniques, Selection (Switched) Diversity, Maximal Ratio Combining, Adaptive Beam forming or Optimum Combining ,RAKE Receiver Size, Mutual Coupling Effects, Dual-Antenna Performance Improvements ,Downlink Capacity Gains

Skill Development

Course outcomes:

After learning the course the students should be able to:

1. Understand the basic architecture, features and benefits of smart antennas.
2. Able to integrate smart antenna technology with overall communication system design, principle and its performance.
3. Understand fundamental characteristics, problem, architectures and consequences of all wireless communication system.
4. Understand the beam forming techniques and adaptive array techniques.

Text Books:

1. Constantine A. Balanis, Panayiotis I. Ioannides, Introduction to Smart Antennas Morgan & Claypool Publishers.
2. Ahmed El Zooghby, Smart Antenna Engineering, Artech House.

Reference Book:

1. M.J. Bronzel, Smart Antennas, John Wiley, 2004.
2. T.S. Rappaport & J.C.Liberti, Smart Antennas for Wireless Communication, Prentice Hall (PTR) , 1999.
3. R. Janaswamy, Radio Wave Propagation and Smart Antennas for Wireless Communication, Kluwer, 2001 CWT3205 Global Positioning Systems.

MTCS-6 TELECOMMUNICATION SWITCHING AND NETWORKS

Credits	Instruction periods per Week			Exam hrs	Sessional Marks	Exam Marks	Total Marks
	Lectures	Tutorials	Practicals				
4	3	1	-----	3	40	60	100

Course Objectives

1. To understand the working principles of switching systems from manual and electromechanical systems to stored program control systems.
2. The students will be able to apply the knowledge and principles leant to analyze, design, install and manage typical wired and wireless communication systems and networks.

UNIT-I

Resource sharing and need for switching; Circuit switching, Store and forward switching, Packet switching, electronic space division switching, Need for networks, Two stage networks, Three stage networks and n-stage networks.

UNIT-II

Time division switching: Time switching, space switching, Three stage combination switching, n-stage combination switching; Traffic engineering: Hybrid switching, Two/Four wire transmission, Erlang formula and signaling.

UNIT-III

High speed digital access: DSL technology, Cable Modem, SONET.

UNIT-IV

Local area networks: Traditional ETHERNET, fast ETHERNET, Gigabit ETHERNET, Wireless LAN, Bluetooth, Connecting LAN's, Backbone networks.

UNIT-V

Integrated Services Digital Network: Network & protocol architecture, user network interfaces, signaling, inter networking, ISDN standards, expert systems in ISDN, Broadband ISDN.

Course Outcomes:

Students are able to

1: Explain the working principle of switching systems involved in telecommunication switching

2: Assess the need for voice digitization and T Carrier systems

3: Compare and analyze Line coding techniques and examine its error performance

4: Design multi stage switching structures involving time and space switching stages

5: Analyze basic telecommunication traffic theory

PRESCRIBED Text Books:

1. **Telecommunication Switching Systems and Networks- ThiagarajanViswanathan, Prentice Hall, New Delhi, 2001.**
2. **Data Communications and Networking- B.A. Forouzan, TataMcGrawhill, Third Edn., 2004.**

Reference:

1. **Telecommunication Switching,Traffic and Networks-Flood, Pearson Education India,2001**
2. **Telecommunication Switching and Networks-P.Gnanasivam, New Age International,2005.**

MTCS 6b Spread Spectrum Techniques and Multiple Access

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

UNIT- I

Introduction to spread spectrum, spread spectrum techniques, Direct sequence system, frequency hopping system, pulse FM (chirp) system, hybrid systems.

UNIT II

Coding for communication and ranging- Property of codes for spread spectrum, Autocorrelation and cross correlation of codes, composites codes, code selection and signal spectra, error detection and correlation codes.

UNIT –III

Modulation and demodulation- Balance modulator, quadriphase modulator, frequency synthesis for spread spectrum modulation, in line and heterodyne correlation, base band recovery, phase lock loop, costas loop, FM.

UNIT-IV

Need for synchronization, types of synchronizers, RF link- Noise figure, co channel users, dynamic range and AGC, propagation medium, overall transmitter and receiver design.

UNIT V

Test and evaluation of spread spectrum system- selectivity, sensitivity, jamming margin, synch acquisition, processing gain. Transmitter measurements.

Reference Books :

1. R. C. Dixen, “Spread Spectrum Systems with commercial application”, John Wiley, 3rdEd.

2. H. Taube. And D. L. Schilling, “Principle of Communication Systems”. Tata Mc graw Hill, 2nd Ed. Reprint 2007.

MTCS-6C SPEECH SIGNAL PROCESSING

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Course Objectives:

The objectives of this course are to make the student

1. Understand the anatomy and Physiology of Speech Production system and perception model and to design an electrical equivalent of Acoustic model for Speech Production.
2. To understand the articulatory and acoustic interpretation of various phonemes and their allophones.
3. To analyze the speech in time domain and extract various time domain parameters which can be used for various applications like pitch extraction, end point detection, Speech Compression, Speech Synthesis etc.,
4. To study the concept of Homomorphic system and its use in extracting the vocal tract information from speech using Cepstrum which is a bye product of Homomorphic processing of Speech.
5. To study various Speech Signal Processing applications viz: Speech Enhancement, Speech Recognition, Speaker Recognition.
6. To study various Audio coding techniques based on perceptual modeling of the human ear.

Unit – I :

Fundamentals of Digital Speech Processing:

Anatomy & Physiology of Speech Organs, The Process of Speech Production, The Acoustic theory of speech production- Uniform lossless tube model, effect of losses in vocal tract, effect of radiation at lips, Digital models for speech signals.

Perception : Anatomical pathways from the Ear to the Perception of Sound, The Peripheral Auditory system, Hair Cell and Auditory Nerve Functions, Properties of the Auditory Nerve. Block schematics of the Peripheral Auditory system.

Unit – II :

Time Domain models for Speech Processing:

Introduction – Window considerations, Short time energy, average magnitude, average zero crossing rate, Speech vs Silence discrimination using energy and zero crossing, pitch period estimation using a parallel processing approach, the short time autocorrelation function, average magnitude difference function, pitch period estimation using the autocorrelation function.

Linear Predictive Coding (LPC) Analysis :

Basic principles of Linear Predictive Analysis : The Autocorrelation Method, The Covariance method, Solution of LPC Equations : Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, comparison between the methods of solution of the LPC Analysis Equations, Applications of LPC Parameters : Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

Unit – III :

Homomorphic Speech Processing:

Introduction , Homomorphic Systems for Convolution : Properties of the Complex Cepstrum, Computational Considerations , The Complex Cepstrum of Speech, Pitch Detection , Formant Estimation, The Homomorphic Vocoder.

Speech Enhancement:
Speech enhancement techniques : Single Microphone Approach, Spectral Subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter, Multi Microphone Approach.

Unit – IV:
Automatic Speech Recognition:
Basic pattern recognition approaches, parametric representation of Speech, Evaluating the similarity of Speech patterns, Isolated digit Recognition System, Continuous word Recognition system. Elements of HMM, Training & Testing of Speech using HMM.

Automatic Speaker Recognition:
Recognition techniques, Features that distinguish speakers, MFCC, delta MFCC, Speaker Recognition Systems: Speaker Verification System , Speaker Identification System, Performance Metrics.

Unit – V:
Audio Coding :
Lossless Audio Coding, Lossy Audio coding, Psychoacoustics , ISO-MPEG-1 Audio coding , MPEG - 2 Audio coding, MPEG - 2 Advanced Audio Coding, MPEG - 4 Audio Coding.

Course Outcomes:
On completion of this course student will be able to
1. Model an electrical equivalent of Speech Production system.
2. Extract the LPC coefficients that can be used to Synthesize or compress the speech.
3. Design a Homomorphic Vocoder for coding and decoding of speech.
4. Enhance the speech and can design an Isolated word recognition system using HMM.
5. Can extract the features for Automatic speaker recognition system which can used for classification.
6. Can design basic audio coding methods for coding the audio signal.

TEXT BOOKS:
1. Digital Processing of Speech Signals - L.R. Rabiner and S. W. Schafer. Pearson Education.
2. Digital Audio Signal Processing – Udo Zolzer, 2nd Edition, Wiley.
3. Speech & Audio Signal Processing- Ben Gold & Nelson Morgan, 1st Ed., Wiley

REFENCE BOOKS:
1. Discrete Time Speech Signal Processing: Principles and Practice - Thomas F. Quateri, 1st Ed., PE.
2. Digital Processing of Speech Signals. L.R Rabinar and R W Jhaung, 1978, PHI.

Speech Communications: Human & Machine - Douglas O'Shaughnessy, 2nd Ed., EEE Press.

MTCS-7 COMMUNICATION SYSTEMS LABORATORY

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
2	-	-	3	3	50	50	100

LIST OF EXPERIMENTS

1. Measurement of VSWR using Microwave bench.
2. S-parameter estimation of Microwave devices.
3. Study of antenna trainer system.
4. Characteristics of Horn antenna.
5. Generation & detection of binary digital modulation techniques.
6. Spread Spectrum communication system-Pseudo random binary sequence generation-Baseband DSSS.
7. Digital Filter Design
8. Channel equalizer design(LMS,RLS)
9. Antenna Radiation Pattern measurement
10. Study of Manchester code on optical fiber kit.
11. Measurement of optical losses in fiber optic communication.
12. Study of spectrum analysis using Spectrum analyzer.

Employability

MTCS-9 COMMUNICATION NETWORKS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Course Objectives:
1. Build an understanding of the fundamental concepts of computer networking.
2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
3. Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
4. Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Employability

Syllabus
Unit I: Virtual-Circuit Networks: Frame Relay and ATM **(10hrs)**
FRAME RELAY , Architecture , Frame Relay Layers , Extended Address , ATM , Design Goals , Problems, Architecture , Switching , ATM Layers , ATM Adaptation layers, ATM LANs ,ATM LAN Architecture. (Text Book 1&2)

Employability

Unit II: Peer – to – Peer Protocols **(10hrs)**
Peer – to- Peer Protocol & service models, ARQ protocols & reliable data transfer service, other Peer – to- Peer Protocols, process – to process delivery, user datagram protocol. (Text Book 1&2)

Employability

Unit III: Transmission control protocol/ Internet Protocol Networks **(12hrs)**
TCP/IP Architecture, internet protocol, IPv6, Transmission control protocol, Stream Control Transmission Protocol, forwarding, unicast routing protocols, multicast routing protocols. (Text Book 1)

Employability

Unit IV: Advanced Network Architectures **(12hrs)**
Architecture, web documents, HTTP, Integrated services in the internet, RSVP, differentiated services, network interconnection models, real-time transport protocols. (Text Book 1&2)

Unit V: Security Protocols **(10hrs)**
Symmetric-key & asymmetric –key cryptography, IP Security, Secure Socket Layer **/**Transport Layer Security, Pretty Good Privacy, Firewalls (Text Book 2)

Text Books:
1. Alberto Leon Gracia and Indra Widjaja, "Communication networks," Second Edition, Tata McGraw Hill, 2008.
2. Behrouza A. Forouzan," Data Communications and Networking", Fourth Edition, Tata McGraw Hill,

Reference Books:
1. Introduction to Data communications and Networking, W.Tomasi, Pearson education

Course Outcomes:
After completing this course the student must demonstrate the knowledge and ability to:

1. Independently understand basic computer network technology.
2. Understand and explain Data Communications System and its components.
3. Identify the different types of network topologies and protocols.
4. Enumerate the layers of the TCP/IP. Explain the function(s) of each Layer.
5. Familiarity with the basic protocols of computer networks, and how they can be secure in network design and implementation.

MTCS 10 WIRELESS COMMUNICATION SYSTEMS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
04	03	01	00	03	40	60	100

Course Objectives:

1. Understand the basic Propagation models
2. Able to analyze the capacity of wireless channels
3. Aable to understand the different Diversity and equalization techniques
4. Able to understand the basic concepts of MIMo Channel

Unit 1: Radio Wave Propagation

Free space propagation model- basic propagation mechanisms –reflection- ground reflection model-diffraction-scattering-practical link budget design-outdoor and indoor propagation models

Small scale fading and multipath: Small scale multipath propagation-Impulse response model of a mulitpath channel –small scale multipath measurements-parameters of mobile multipath channels - –types of small scale fading.

Unit 2: Capacity of Wireless Channels and Performance of digital modulation over wireless channels

Capacity of Flat Fading Channel- Channel Distribution Information known – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver – Capacity with Receiver diversity – Capacity comparisons – Capacity of Frequency Selective Fading channels.

Error probability of M-ary PSK, M-ary QAM and M-ary FSK , MSK, GMSK, on AWGN channels- Fading– Outage Probability– Average Probability of Error –– Combined Outage and Average Error Probability.

Unit 3: Diversity

Realization of Independent Fading Paths – Receiver Diversity – Selection Combining – Threshold Combining – Maximal-Ratio Combining – Equal - Gain Combining – Transmitter Diversity – Channel known at Transmitter – Channel unknown at Transmitter – The Alamouti Scheme-basic concepts of RAKE receivers.

Unit 3: Equilization

Fundamentals of equalization ,Training A Generic Adaptive Equalizer,Equilizers in a Communications Receivers, Survey of Equilization Techniques, Linear Equilizers, NonLinear Equilization,Alogorithms for Adaptive Equilization , Fractionslly Spaced Equalizers

Unit 5: Multiple Access Techniques and MIMO and multicarrier modulation:

Frequency division multiple access-time division multiple access-spread spectrum multiples access-space division multiple access- packet radio.

Narrowband MIMO model-parallel decomposition of MIMO channel-MIMO channel capacity-MIMO diversity gain –data transmission using multiple carriers-multicarrier modulation with overlapping subchannels-mitigation of subcarrier fading-basic concepts of OFDM.

Text Books:

1. Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005
2. T.S. Rappaport, "Wireless Communications," Pearson Education, 2003

Reference Books:

1. Raj Pandya, "Mobile and Personal Communication Systems and Services," Prentice Hall of India, 2002
2. William C.Y. Lee, "Wireless and Cellular Telecommunications," Third edition, Mc. Graw Hill, 2006.

COURSE OUTCOMES

After completing the Course , Students is able to

1. Analyze the propagation models of free space.
2. leads to current and upcoming wireless communications technologies for broadband wireless access network design and research.
3. Do research in system evaluation methods used in the design of communications network.

MTCS-11 Multimedia and communications systems

Course Objectives:

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	--	3hrs	40	60	100

1. To understand the Multimedia Communication Models and to study the Multimedia Transport in Wireless Networks.
2. To solve the Security issues in multimedia networks and to explore real-time multimedia network applications.
3. To explore different network layer based application.
3. To understand the process of compressing and sending text, image, audio and video signals over networks.
4. To gain knowledge of various entertainment networks.

UNIT I: Multimedia communications **(6hrs)**

Introduction, multimedia networks, multimedia applications, Digitization principles, Text, Images, Video, Audio.

UNIT II: Text and Image Compression **(15hrs)**

Compression Principles, Text compression, Image compression.

UNIT III: Audio and Video Compression **(15hrs)**

DPCM, ADPCM, Adaptive predictive coding, Linear predictive coding, code-excited LPC, perceptual coding, MPEG audio coders, Dolby audio coders, video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, MPEG-4.

UNIT IV: Standards for multimedia communications **(15hrs)**

Reference Models, Standards related to interpersonal communications, Standards relating to interactive applications over the internet, standards for entertainment applications.

UNIT-V: Entertainment networks and internet applications **(8hrs)**

Cable TV networks, Satellite television networks, high-speed PSTN access technology, DNS, Email, FTP, TFTP, Internet telephony, SNMP.

Text Books:

1. Fred Halsall – Multimedia Communications, Pearson publication 2001.
2. Ze-Nian Li, Marks. Drew- Fundamentals of Multimedia, PHI publications 2004.

Course outcomes:

1. Deploy the right multimedia communication models.
2. Apply multimedia network applications with efficient routing techniques.
3. Solve the security threats in the multimedia networks.
4. Develop the real-time multimedia network applications.
5. Explore different entertainment networks.

MTCS 12 a Software Defined Radio

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

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UNIT-I

A Basic Software Defined Radio Architecture –Introduction – 2G Radio Architectures- Hybrid Radio Architecture- Basic Software Defined Radio Block Diagram- System Level Functioning Partitioning-Digital Frequency Conversion Partitioning.

Employability

UNIT-II

RF System Design – Introduction- Noise and Channel Capacity- Link Budget- Receiver Requirements- Multicarrier Power Amplifiers- Signal Processing Capacity Tradeoff.

Analog-to-Digital and Digital-to-Analog Conversion- Introduction – Digital Conversion Fundamentals- Sample Rate- Bandpass Sampling- Oversampling- Antialias Filtering – Quantization – ADC Techniques-Successive Approximation- Figure of Merit-DACs- DAC Noise Budget- ADC Noise Budget.

UNIT-III

Digital Frequency Up- and Down Converters- Introduction- Frequency Converter Fundamentals- Digital NCO- Digital Mixers- Digital Filters- Halfband Filters- CIC Filters- Decimation, Interpolation, and Multirate Processing-DUCs - Cascading Digital Converters and Digital Frequency Converters.

Employability

UNIT-IV

Signal Processing Hardware Components- Introduction- SDR Requirements for Processing Power- DSPs- DSP Devices- DSP Compilers- Reconfigurable Processors- Adaptive Computing Machine- FPGAs

Employability

Software Architecture and Components – Introduction- Major Software Architecture Choices – Hardware – Specific Software Architecture- Software Standards for Software Radio-Software Design Patterns- Component Choices- Real Time Operating Systems- High Level Software Languages- Hardware Languages.

Employability

UNIT V

Smart Antennas Using Software Radio- Introduction- 3G smart Antenna Requirements- Phased Antenna Array Theory- Applying Software Radio Principles to Antenna Systems- Smart Antenna Architectures- Optimum Combining/ Adaptive Arrays- DOA Arrays- Beam Forming for CDMA- Downlink Beam Forming.

Employability

Course Outcomes: At the end of the course the student will be able to:

CO1 Conceptualize the SDR and implementation details
CO2 Design SDR for a specific application
CO3 Identify the challenges in the maintenance of SDR
CO4 Analyse the transmitter and receiver architectures

References:

1. Paul Burns, Software Defined Radio for 3G, Artech House, 2002.
2. Tony J Rouphael, RF and DSP for SDR, Elsevier Newnes Press, 2008
3. Jouko Vanakka, Digital Synthesizers and Transmitter for Software Radio, Springer, 2005.
4. P Kenington, RF and Baseband Techniques for Software Defined Radio, Artech House, 2005.

MTCS 12 b MODERN RADAR SYSTEMS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

UN IT-I

Fundamentals of Surveillance Radar and Design :

Bandwidth considerations, prf, Unambiguious range and velocity, Pulse length and Sampling, Radar Cross-section and Clutter.

Employability

UN IT-II

Tracking Radar :

Tracking and Search Radars, Antenna beam shapes required, Radar guidance, Frequency agility, Importance of Monopulse Radar.

Employability

UN IT-III

Radar waveform design :

Bandwidth and pulse duration requirements, Range and Doppler accuracy uncertainty relation, pulse compression and phase coding.

Employability

UN IT-IV

Principles of Secondary Surveillance Radar,

Radar studies of the atmosphere, OHR and Radar jamming, EC, ECC measures and stealth applications.

Employability

Course Outcomes

At the end of the Course,student will be able to:

1.Interpret the various bandwidth considerations related to survellience radar and design

2.Illustrate the various tracking methods and significance of monopulse radar

3.Design a Radar waveform,given bandwidth and pulse duration.

4.Understand the principles of secondary surveillance for various stealth applications.

Text Books :

1. “Understanding of Radar Systems”, Simon Kingsley and Shaun Quegan, McGraw Hill, 1993.
2. Radar Handbook by Skolnik.

MTCS-12 DIGITAL IMAGE PROCESSING

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	Lecture	Tutorial	Practical				
4	4	1	-	3	40	60	100

Course Objectives:

1. To learn Image Fundamentals and Processing Techniques
2. To be familiar with Image Transformations in Spatial Domain and Frequency Domain
3. To learn various Filters for Image Restoration
4. To study various Image Compression and Segmentation Techniques
5. To gain experience in applying image processing algorithms to real problems

UNIT I – DIGITAL IMAGE FUNDAMENTALS (8 hours)

Introduction – Origin –Steps in Digital Image Processing – Components; Elements of Visual Perception – Light and Electromagnetic Spectrum – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels.

Employability

UNIT II – IMAGE ENHANCEMENT (9 hours)

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

Employability

UNIT III –IMAGE RESTORATION (9 hours)

Noise models – Mean filters – Order Statistics – Adaptive filters – Band reject – Band pass – Notch – Optimum notch filtering – Inverse Filtering – Constrained Least Square Filtering – Wiener filtering.

Employability

UNIT IV –IMAGE COMPRESSION (9 hours)

Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding –Bit – Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding –Wavelet Coding – Compression Standards JPEG2000.

Employability

UNIT V –IMAGE SEGMENTATION AND REPRESENTATION (10 hours)

Segmentation – Detection of Discontinuities – Edge Linking and Boundary detection – Region based segmentation; Representation – Boundary descriptors – Simple Descriptors – Shape numbers –Regional descriptors – Simple and Topological Descriptors – Introduction to Image Processing Toolbox – Practice of Image Processing Toolbox – Case studies–Various Image Processing Techniques.

Employability

Text books:

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Pearson Education, Third Edition, 2010.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
3. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Tata McGraw Hill Pvt. Ltd., Third Edition, 2011.

Reference books:

1. Rosefeld & Kak AC, Digital Picture Processing Academic Press Inc.
2. Sonka Milan, "Image Processing Analysis and Machine vision", Cengage Learning
3. William K. Pratt, "Digital Image Processing", Wiley India Pvt. Ltd.

Course Outcomes:

At the end of the course, the student will be able to:

1. Understand the basic concepts of two-dimensional signal acquisition, sampling, and quantization.
2. Apply 2D Fourier transform concepts for image enhancement.
3. Remove various noises present in an image using different filters.
4. Understand various coding techniques for image compression.
5. To use the techniques, skills, and modern engineering tools necessary for image processing applications.

MTCS-13 RF AND MICROWAVE ENGINEERING

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Course Objectives:
This course is intended to introduce to students:

(i) The concepts of scattering parameters signal flow graphs, and their applications in microwave circuit analysis and design .

(ii) Concepts of planar transmission lines, lumped/distributed circuit elements, impedance matching circuits, resonators, dividers, couplers, filters and duplexers.

Chapter 1 : Introduction to RF and Microwave concepts and applications (8hrs)

Introduction, Reasons for using RF/Microwaves, RF/Microwave applications, Radio frequency waves, RF and Microwave circuit design, The unchanging fundamentals versus the ever-evolving structure, General active circuit block diagrams.

Chapter 2 : RF Electronics Concepts (10hrs)

Introduction, RF/Microwaves versus DC or low AC signals, EM spectrum, Wave length and frequency,
Circuit representation of two port RF/microwave networks. Basics of RF component, Resonant circuits, Analysis of a simple circuit in phasor domain, Impedance transformers, RF impedance matching, Three element matching.

Chapter 3 : Smith Chart and its Applications (12hrs)

Introduction, A valuable graphical aid the smith chart, Derivation of smith chart, Description of two types of smith charts, Smith charts circular scales, Smith charts radial scales, The normalized impedance-admittance (ZY) smith chart introduction, Applications of the smith chart - Distributed circuit applications, Lumped element circuit applications.

Employability

Chapter 4 : RF and Microwave Amplifiers Small and Large Signal Design (18hrs)

Introduction, Types of amplifiers, Small signal amplifiers, Design of different types of amplifiers, Multistage small signal amplifier design.

Introduction, High-power amplifiers, Large signal amplifier design, Microwave power combining/dividing techniques, Signal distortion due to inter modulation products, Multistage amplifiers, Large signal design

Employability

Chapter 5 : Radio Frequency and Microwave Oscillator Design (10hrs)

Introduction, Oscillator versus amplifier design, Oscillation conditions, Design of transistor oscillators, Generator-tuning networks.

Employability

Text Book :

"Radio Frequency and Microwave Electronics", by Mathew M. Radmanesh, Person Education Inc., New Delhi

References

"Microwave Engineering, Active and Non-reciprocal Circuits", by Joseph Helszain, McGraw Hill International Edition, 1992

MTCS 13 b WAVELET TRANSFORMS AND ITS APPLICATIONS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Unit – I:

Continuous And Discrete Wavelet Transform: Continuous time ;wavelets transform (CWT): Definition, CWT as a correlation, Constant Q factor filtering interpretation and time frequency resolution, CWT as an operator, Inverse CWT, Discrete Wavelet Transform: Approximations of vectors in Nested Linear Vector Subspaces – Multiresolution analysis (MRA) with examples.

Skill Development

Unit – II:

Orthonormal Wavelets And Filter Banks: Definition of an MRA- construction of a General Orthonormal MRA – Wavelet Basis for the MRA-Digital filtering Interpretation- Examples of orthonormal Basis – Generating Wavelets- Interpreting Orthonormal MRAs for Discrete – time Signals Miscellaneous Issues Related to PRQMF Filter Banks-Generating Scaling Functions and Wavelets from Filter Banks – Generating Scaling functions and Wavelets from Filter coefficients – Problems.

Skill Development

Unit – III:

Alternative Wavelet Transforms: Biorthogonal Wavelet Bases – Filtering Relations for Orthogonal Filters-Examples of Biorthogonal Scaling Functions and Wavelets-Two Dimensional Wavelets- Nonseperable Multidimensional Wavelets- Wavelet Packets – Transform Coding – DTWT for Image Compression – Audio Compression – Video Coding Using Multiresolution Techniques.

Skill Development

Unit – IV:

Applications of Wavelet Transforms: Wavelet Denoising – Speckle Removing – Edge Detection and Object Isolation - Image Fusion-Object Detection by Wavelet Transforms of Projections – Communication Applications – Scaling Functions as signaling pulses, Discrete Wavelet Multitone Modulation.

Skill Development

Unit – V:

Advanced Topics: Parseval's Identity for CWT Wavelet inner product as a projection operation CWT with an orthonormal basis for generating wavelet – A Trous algorithm-Regularity and Convergence – Daubechies Construction of Orthonormal Scaling Functions – Bandlimited Bi-orthogonal Decomposition – Design and Selection of Wavelets – Perfect Reconstruction Circular Convolution Filter Banks-Interpolators Matches to the Input Process – The Scaling Operation and Self-Similar Signals.

Skill Development

Text Book:

1. Raghuveer M. Rao and Ajit S. Bopardikar, "Wavelet Transforms – Introduction to Theory and Applications" Addison Wesley Pearson Education Asia, 2000.

Reference Book:

1. C.Sidney Burrus, Ramesh A Gopinath, and Haitao Guo, "Introduction to Wavelets and Wavelet Transforms, A Primer " PH International Editions, 1998.

MTCS 13 c MODELLING AND SIMULATION OF COMMUNICATION SYSTEMS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

UNIT I
Simulation of Random Variables and Random Process:
Univariate and multi-variate models, Transformation of random variables, Bounds and approximation, Random process models-Markov AND ARMA sequences, Sampling rate for simulation, Computer generation and testing of random numbers.

UNIT II
Modeling of Communication Systems:
Information Sources, Formatting/Source Coding, Digital Waveforms, Line Coding, Channel Coding, Radio frequency and Optical Modulation, Demodulation and Detection, Filtering, Multiplexing/Multiple Access, Synchronization, Calibration of Simulations.

Employability

UNIT III
Communication Channels & Models:
Fading & Multipath Channels, Almost Free-Space Channels, Finite State Channel Models, Methodology for Simulating Communication Systems Operating over Fading Channels, Reference Models for Mobile Channels: GSM, UMTS-IMT-2000.

Employability

UNIT IV
Estimation of Parameters in Simulation:
Quality of an estimator, Estimating the Average Level of a Waveform, Estimating the Average power of a waveform, Estimating the Power Spectral Density of a process, Estimating the Delay and Phase.

Employability

UNIT V
Estimation of Performance Measures from Simulation:
Estimation of SNR, Performance Measures for Digital Systems, Importance sampling method, Efficient Simulation using Importance Sampling, Quasianalytical Estimation. Case Studies: 16-QAM Equalized Line of Sight Digital Radio Link, CDMA Cellular Radio System.

Employability

Text Book:

1. William H. Tranter, K. Sam Shanmugan, Theodore S. Rappaport, Kurt L. Kosbar, "Principles of Communication Systems Simulation with Wireless Applications", Prentice Hall PTR, 2002.
2. John G. Proakis, Masoud Salehi, Gerhard Bauch, Bill Stenquist, Tom Ziolkowski, "Contemporary Communication Systems Using MATLAB" Thomson-Engineering, 2 edition, 2002.

Reference books:

1. M.C. Jeruchim, Philip Balaban and K.Sam Shanmugam, "Simulation of Communication Systems, Modeling, Methodology and Techniques", Kluwer Academic/Plenum Publishers, New York, 2000.
2. C. Britton Rorabaugh, "Simulating Wireless Communication Systems: Practical Models In C++"Prentice Hall, 2004.

MTCS-14 STATISTICAL SIGNAL PROCESSING

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
04	3	1	0	3	40	60	100

Course Objectives:

1. To understand the fundamentals of Estimation Theory
2. To understand Deterministic Parameter Estimation
3. To understand Random Parameter Estimation:
4. To understand State Estimation
5. To understand the Fundamentals of Detection Theory

Syllabus

Unit-I. : Fundamentals of Estimation Theory (8 hrs)

Estimation in Signal Processing, Unbiased Estimators, Existence of the Minimum variance unbiased estimator. Finding Minimum variance unbiased Estimators, Cramer-Rao Lower Bound, Linear Model Examples, Sufficient Statistics, Using Sufficiency to find the MVU Estimator.

Unit-II. Deterministic Parameter Estimation (11 hrs)

The Least Squares Approach, Order- Recursive Least Squares, Definition of the BLUE, Finding the BLUE. Maximum Likelihood Estimation: Finding the MLE, Properties of the MLE , MLE for Transformed parameters, Numerical Determination of the MLE.

Unit-III. Random Parameter Estimation: (10 hrs)

The Bayesian Philosophy: Prior Knowledge and Estimation, Choosing a Prior PDF, Bayesian linear model, Nuisance parameters,Bayesian Estimation for Deterministic parameters,Derivation of Conditional Gaussian PDF,Minimum Mean Square Error Estimator, Maximum a Posteriori Estimators.

Unit-IV. State Estimation: (9 hrs)

Linear Minimum Mean Squared Error Estimation, Signal processing examples- Wiener Filtering,
Kalman Filters: Scalar Kalman Filter, Kalman versus Wiener Filters, Extended Kalman Filter.

Unit-V. Fundamentals of Detection Theory: (14 hrs)

Statistical Decision Theory: Neyman - Pearson Theorem, Receiver Operating Characteristics, Irrelevant Data, Minimum Probability of Error, Bayes Risk, Multiple Hypothesis Testing -Composite Hypothesis Testing, Composite Hypothesis Testing Approaches, Performance of GLRT, Multiple Hypothesis Testing

Text books:

1. Steven M. Kay, "Fundamentals of Statistical Signal Processing Volume I Estimation Theory", Prentice Hall PTR, 1993. (UNIT- I, II, III & IV)
2. Steven M. Kay, "Fundamentals of Statistical Signal Processing Volume II Detection Theory", Prentice Hall PTR, 1998 (UNIT- V)

Reference books:

1. M D Srinath, P K Rajasekaran, R Viswanathan, Introduction to Statistical Signal Processing with Applications, "Pearson"
2. Harry L. Van Trees, "Detection, Estimation and Modulation Theory, Part 1 and 2," John Wiley & Sons Inc. 1968.
3. Monson H. Hayes, "Statistical Digital Signal Processing and Modelling," John Wiley & Sons Inc., 1996.
4. Random Signals: Detection, Estimation and Data Analysis - K. Sam Shanmugan & A.M. Breipohl, Wiley India Pvt. Ltd, 2011.
5. *An Introduction to Signal Detection and Estimation*, Second Edition, by H. Vincent Poor. Springer Verlag, 1994
6. Decision and estimation theory. James L. Melsa, Davíd L. Cohn. McGraw-Hill, 1978

Course Outcomes:

At the end of the course, the student will be able to:

1. Learn about basic Estimation Methods: Maximum Likelihood Estimation, Maximum Aposteriori Estimation, Minimum Variance Unbiased Estimation, Minimum Mean Square Error Estimation, Linear Minimum Mean Square Error Estimation and Kalman Filtering
2. Learn about basic estimator properties such as Bias, Efficiency, Linearity
3. Learn Classical and Bayesian Estimation Approaches
4. Learn Basic Estimation Performance Bounds such as Cramer-Rao Bound
5. Gain ability to apply estimation methods to real engineering problems.
6. Able to analyze and design decision devices using Bayes' risk formulation
7. Able to analyze and design decision devices using the Neyman-Pearson criterion

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MTCS -14 b CPLD AND FPGA ARCHITECTURE AND APPLICATIONS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

UNIT I

PROGRAMMABLE LOGIC DEVICES:

COMPLEX PROGRAMMABLE LOGIC DEVICES (CPLD): Employability

ROM, PLA, PAL, PLD, PGA – Features, programming and applications using complex programmable logic devices Altera series – Max 5000/7000 series and Altera FLEX logic – 10000 series CPLD, AMD's – CPLD (Mach 1 to 5); Cyprus FLASH 370 Device Technology, Lattice LSI's Architectures – 3000 Series – Speed Performance and in system programmability.

Field Programmable Gate Arrays (FPGA)

Field Programmable Gate Arrays – Logic blocks, routing architecture, Design flow, Technology Mapping for FPGAs.

UNIT-II

Employability

FPGA/CPLD ARCHITECTURES:

Xilinx XC4000 & ALTERA's FLEX 8000/10000 FPGAs: AT & T –
ORCA's (Optimized Reconfigurable Cell Array): ACTEL's – ACT-1, 2, 3 and their speed performance.

UNIT III

FINITE STATE MACHINES (FSM):

Top Down Design – State Transition Table, state assignments for FPGAs. Problem of initial state assignment for one hot encoding. Derivations of state machine charges. Realization of state machine charts with a PAL.

Alternative realization for state machine chart using microprogramming. Linked state machines. One – Hot state machine, Petrinets for state machines – basic concepts, properties, extended petrinets for parallel controllers. Finite State Machine – Case Study, Meta Stability, Synchronization.

UNIT IV

Employability

FSM ARCHITECTURES:

Architectures centered around non-registered PLDs. State machine designs centered around shift registers. One – Hot design method. Use of ASMs in One – Hot design. Application of One – Hot method.

UNIT V

SYSTEM LEVEL DESIGN:

Controller, data path and functional partitions, Parallel adder cell, parallel adder sequential circuits, counters, multiplexers, parallel controllers.

TEXT BOOKS:

1. P.K.Chan & S. Mourad, "*Digital Design Using Field Programmable Gate Array*", prentice Hall (Pte), 1994.
2. S.Brown, R.Francis, J.Rose, Z.Vransic, "*Field Programmable Gate Array*", Kluwer Publications, 1992.

REFERENCE BOOKS:

1. J. Old Field, R.Dorf, "*Field Programmable Gate Arrays*", John Wiley & Sons, New York, 1995.
2. S.Trimberger, Edr. "*Field Programmable Gate Array Technology*", Kluwer Academic Publications, 1994.
3. Bob Zeidman, "*Designing with FPGAs & CPLDs*", CMP Books, 2002.

MTCS 14 c ADHOC NETWORKS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

UNIT I ROUTING

Cellular and Ad hoc wireless networks – Issues of MAC layer and Routing – Proactive, Reactive and Hybrid Routing protocols – Multicast Routing – Tree based and Meshbased protocols – Multicast with Quality of Service Provision

UNIT II QUALITY OF SERVICE

Real-time traffic support – Issues and challenges in providing QoS – Classification of QoS Solutions – MAC layer classifications – QoS Aware Routing Protocols – Ticket based and Predictive location based QoS Routing Protocols

UNIT III ENERGY MANAGEMENT AD HOC NETWORKS

Need for Energy Management – Classification of Energy Management Schemes – Battery Management and Transmission Power Management Schemes – Network Layerand Data Link Layer Solutions – System power Management schemes

UNIT IV MESH NETWORKS

Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture – Opportunistic Routing – Self Configuration and Auto Configuration - Capacity Models – Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks

UNIT V SENSOR NETWORKS

Introduction – Sensor Network architecture – Data Dissemination – Data Gathering – MAC Protocols for sensor Networks – Location discovery – Quality of Sensor Networks – Evolving Standards – Other Issues – Recent trends in Infrastructure less Networks

Text Books:

1. C. Siva Ram Murthy and B.S. Manoj, “Ad hoc Wireless Networks – Architectures and Protocols’, Pearson Education, 2004

Reference:

1. Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks”, MorganKaufmanPublishers, 2004
2. C.K. Toh, “Adhoc Mobile Wireless Networks”, Pearson Education, 2002.
3. Thomas Krag and SebastinBuettrich, ‘Wireless Mesh Networking’, O’ReillyPublishers.

MTCS 15 Signal Processing Lab

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
2	-	-	3	3	50	50	100

List of Experiments

Cycle-I: Digital Signal Processing based Experiments:

1. Write a MATLAB program to find (i) Circular convolution of the given two sequences (ii) Linear convolution using circular convolution.
2. Write a MATLAB program to find the spectrum of the given sequence using FFT.
3. Write a MATLAB program to design Butterworth (i) low pass filter for the given specifications.
4. Write a MATLAB program to design Chebyshev type-I (i) low pass filter for the given specifications.
5. Write a MATLAB program to convert given analog filter into digital filter using Bilinear transformation
6. Write a MATLAB program to plot the frequency response of low pass filter using Kaiser window for different values of β

Employability

Cycle-II:Digital Image Processing based Experiments:

1. Write a program forfollowing geometric transformation on image
   (a) Translation(b) Scaling(c) Rotation (d) Shrinking (e) Zooming
2. Write a Program in MATLAB to
   a. Obtain Negative image b. Thresholding c. Contrast stretching (Linear & Non-linear)
3. Write a program to
   (a) compute the histogram of an input image
   (b) To improve the appearance using histogram equalization technique.
5. Write a program to performsmoothing and sharpening operation of an image using spatial filtering
6. Write programs for image
   (a) Apply FFT and IFFT on given image(b) Perform low pass and high pass filtering in frequency domain
7. Write a program in MATLAB for edge detection using different edge detection mask
8. Write programsto implement following morphological operations on images
   (a)Erosion (b) Dilation(c)Closing(d)Opening

Employability

MTCST111 Theory of Computation

Periods/week 3 Time: 3 Hours Credits: 4 Internal: 40 Marks External: 60 Marks Total: 100

Marks --

UNIT-I

Finite Automata, Deterministic finite automata, Non deterministic finite automata, finite automata with epsilon transitions. Application of finite automata.

Employability

UNIT-II

Regular Expressions, finite automata and regular expressions, algebraic laws of regular expressions, Application of regular expression.

Employability

UNIT-III

Employability

Context free grammars, The language of a grammar, sentential form, parse trees, ambiguity in grammars and languages, Applications of context free grammar

Employability

UNIT-IV

Normal forms for context free grammer, Chomsky normal form, The pumping lemma for context free languages. Decision properties of context free language.

Employability

UNIT-V

Push down automata, Languages of a PDA,. parsing and pushdown automation. Turing machine, Programming techniques for turing machine, restricted turing machines, turing machine and computers.

Text Books

Employability

1. Introduction to automata theory, language & computations- Hopcroft & O.D. Ullman, R. Mothwani. AW, 2001
2. Theory of Computer Science(automata, languages, and computation): K.L.P Mishra and N. Chandrasekaran, PHI,2000
3. Introduction to formal languages & automata- Peter Linz, Narosa Pub. 2001.
4. Fundamentals of the theory of computation- principles and practice by Ramond Greenlaw and H . James Hoover, Harcourt India Pvt. Ltd.1998.
5. Elements of theory of computation by H.R. Lewis & C.H. Papaditriou, PHI,1998.

MTCST112 SOFTWARE PROJECT MANAGEMENT

Instruction: 3 Periods/week Time: 3 Hours Credits: 4

Internal: 40 Marks External: 60 Marks Total: 100 Marks

UNIT I Software Process Maturity Software maturity Framework**,** Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models Capability Maturity Model (CMM)**,** CMMI, PCMM, PSP, TSP.

UNIT II Software Project Management Renaissance Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way. Life-Cycle Phases and Process artifacts Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model based software architectures.

UNIT III Workflows and Checkpoints of process Software process workflows, Iteration workflows, Major milestones, Minor milestones, Periodic status assessments. Process Planning Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

UNIT IV Project Organizations Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation The seven core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, and metrics automation.

UNIT V CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

TEXT BOOKS:

1. Managing the Software Process, *Watts S. Humphrey*, Pearson Education.
2. Software Project Management, *Walker Royce,* Pearson Education.
3. Effective Project Management: Traditional, Agile, Extreme, Robert Wysocki, Sixth edition, Wiley India, rp2011.
4. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000 5. Process Improvement essentials, James R. Persse, O'Reilly, 2006

MTCST113 ADVANCED DATABASE MANAGEMENT SYSTEM

Instruction: 3 Periods/week Time: 3 Hours Credits: 4

Internal: 40 Marks External: 60 Marks Total: 100 Marks

EMPLOYABILITY

Unit I Introduction, Parallel database architecture, speedup, scale-up I/O parallelism, Inter-query and Intra-query parallelism, Inter-operational and Intra-operational parallelism, parallel query evaluation, Design of parallel systems, Implementation issues of Parallel query evaluation, Design of parallel systems, Comparison of Inter-query and Intra-query parallelism.

EMPLOYABILITY

EMPLOYABILITY

Unit II Distributed Databases, Study of DDBMS architectures, Comparison of Homogeneous and Heterogeneous Databases, Analysis of Concurrency control in distributed databases, Implementation of Distributed query processing. Distributed data storage, Distributed transactions, Commit protocols, Availability, Distributed query processing, Directory systems-ldap, Distributed data storage and transactions.

EM

EMPLOYABILITY

EMPLOY

Unit III Overview of client server architecture, Databases and web architecture, N-tier architecture, XML, Introduction, Structure of XML Data, XML Document Schema, DTD, Querying and Transformation: XQuery, FLOWR, XPath, XML validation, Web server, API to XML, Storage of XML Data, XML Applications: web services, Web based system, Implementation of XML validations, Use of web servers. XML and DTD implementation, Use of Web service like Amazon web service or Microsoft Azure.

EMP

Unit IV Introduction to Decision Support, Data Warehousing, Creating and maintaining a warehouse. Introduction to Data warehouse and OLAP, Multidimensional data model, Data Warehouse architecture, OLAP and data cubes, Operations on cubes, Data preprocessing need for preprocessing, Multidimensional data model, OLAP and data cubes, Data warehousing Concepts, Study of Data preprocessing need for preprocessing, Simulating and maintaining a Warehouse, Analysis of Data preprocessing. Introduction to data mining , Data mining functionalities, clustering - k means algorithm, classification - decision tree, Baysian classifiers, Outlier analysis, association rules - apriori algorithm, Introduction to text mining, Implementing Clustering - k means algorithm, Analysis of Decision tree.

Unit V Information retrieval - overview, Relevance ranking using terms and hyperlinks, synonyms, homonyms, ontologies, Indexing of documents, measuring retrieval effectiveness, web search engines, Information retrieval and structured data. Information Retrieval, Study and Comparison of Synonyms, Homonyms, Ontologies. Implementation issues of Relevance ranking Algorithm.

EMPLO

Text Books:

1. Database System Concepts, Avi Silberschatz , Henry F. Korth , S. Sudarshan McGraw-Hill, Sixth Edition, ISBN 0-07-352332-1.

2. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke,McGraw-Hill.

MTCST114 Elective-I IMAGE PROCESSING

Instruction: 3 Periods/week Time: 3 Hours Credits: 4

Internal: 40 Marks External: 60 Marks Total: 100 Marks

UNIT-I

DIGITAL IMAGE FUNDAMENTALS : What Is Digital Image Processing?, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Image Sensing and Acquisition, Some Basic Relationships between Pixels, An Introduction to the Mathematical Tools Used in Digital Image Processing.

Employability

UNIT-II

Intensity Transformations and Spatial Filtering: Background, Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

Employability

UNIT-III

Filtering in the Frequency Domain: Background, Preliminary Concepts, DFT, Some Properties of the 2-D Discrete Fourier Transform, The Basics of Filtering in the Frequency Domain, Image Smoothing Using Frequency Domain Filters, Image Sharpening Using Frequency Domain Filters, Selective Filtering.

Employability

UNIT-IV

Morphological Image Processing & Image Compression: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms, JPEG Compression model, Huffman coding.

Employability

UNIT-V

Image Segmentation: Fundamentals, Point, Line, and Edge Detection, Thresholding, Region-Based Segmentation.

Employability

Text Books:

Title: "Digital Image Processing". Author(s)/Editor(s): R. C. Gonzalez and R. E. Woods. Publisher: Pearson Prentice-Hall, 2008 ISBN: 0-13-168728-x, 978-0-13-168728-8 Edition: third.

Title: "Digital Image Processing using Matlab". Author(s)/Editor(s): R. C. Gonzalez, R. E. Woods, S. L. Eddins. Publisher: Pearson-Prentice-Hall, 2004 ISBN: 0-13-008519-7 Edition: 2nd .

MTCST114 Elective-I Semantic Web

Instruction: 3 Periods/week Time: 3 Hours Credits: 4

Internal: 40 Marks External: 60 Marks Total: 100 Marks

--- UNIT-I

Introduction to Semantic Web and Ontologies: Today's Web, From Today's Web to the Semantic Web, Semantic Web Technologies, A Layered Approach, Differences Among Taxonomies, Thesauri and Ontologies, Classifying Ontologies, Knowledge Representation in Description Logic.

UNIT-II

Describing Web Resources in RDF: XML Essentials like elements/attributes and URIs and Namespaces, RDF (statements and vocabularies, RDF Triples and Graphs) and RDF Schema (Classes, Properties, Individuals).

UNIT-III

Querying the Semantic Web: SPARQL Infrastructure, Basics Matching Patterns, Filters, Organizing result sets, Other forms of SQL Queries, Querying Schemes, Adding Information with SPARQL Update.

UNIT-IV

Web Ontology Language (OWL): Introduction, Requirements for Web Ontology Description Languages, Header Information, Versioning and Annotation Properties, Properties, Classes and Individuals.

UNIT-V

Logic and Inference Rules: Introduction, Example of Monotonic Rules: Family Relationships, Monotonic Rules: Syntax, Monotonic Rules: Semantics, Semantic Web Rule language (SWRL), Rules in SPARQL: SPIN, Non-monotonic Rules: Motivation and Syntax.

Case Studies: Applications: Software Agents, Semantic Desktop, Ontology Applications in Art.

Text Books:

1. Grigoris Antoniou, Frank Van Harmelen, A Semantic Web Primer, MIT Press, 2008 (Second Edition)
   ISBN: 9780262012423
2. Grigoris Antoniou, Frank Van Harmelen, A Semantic Web Primer, MIT Press, 2012 (Third Edition)
   ISBN: 9780262018289

Reference Books:

1. Karin K. Breitman and Marco Antonio Casanova, Semantic Web: Concepts, Technologies and Applications, Springer, 2010, ISBN:9788184893977

MTCST114 Elective-I EMBEDDED SYSTEMS

Instruction: 3 Periods/week Time: 3 Hours Credits: 4

Internal: 40 Marks External: 60 MarksTotal: 100 Marks

Unit -I

A First look at Embedded systems- Examples of Embedded Systems - Telegraph development challenges, **Hardware fundamentals for software engineers**- Logic gates, Advanced Hardware Fundamentals- microprocessor, D-flip flop, memories, Buses, Watch Dog Timer, DMA, UART and PLD's, ASIC, FPGA.

Interrupts basics, ISR; Context saving, shared data problem. Atomic and critical section, Interrupt latency.

Unit -II

Survey ofsoftware architectures- Round Robin, Round Robin with Interrupt, Function queue scheduling architecture, Use of real time operating system and their comparison.

Unit-III

RTOS- concept, Tasks and Task structures , Scheduler, Shared data, Reentrancy, Priority Inversion, Mutex binary semaphore and counting semaphore. **Inter task communication methods** and their comparison- message queue, mailboxes and pipes, timer functions, events.

Unit- IV

Interrupt routines in an RTOS environment-Rule1 and Rule2, No Blocking, Solutions to Break the Rules,

Basic Design of Embedded Software using an RTOS- Hard real time and soft real time system principles, Task division, need of interrupt routines, shared data.

Employability

Unit -V

Embedded Software Development Tools- Host and target systems, Cross Compilers/Cross Assembler, linkers/locators for embedded systems. Getting embedded software into the target system

Employability

Debugging techniques- T... achine, Instruction set Simulators, logic analyzers. In circuit Emulators and Software-Only Monitors.

Employability

Text Books:

1. David A. Simon, An Embedded Software Primer, Pearson Education, Inc., 1999
2. Sriram V Iyer and Pankaj Gupta, Embedded Real Time Systems programming, TMH,2004
3. Frank Vahid/ Tony Givargis, Embedded Systems Design – A Unified Hardware/Software Introduction, John Wiley & Sons, Inc., 2002
4. Raj Kamal, Embedded Systems, Architecture, Programming and Design, TMH, 2003

MTCST114 Elective-I WIRELESS SENSOR & ACTUATOR NETWORKS

Instruction: 3 Periods/week Time: 3 Hours Credits: 4

Internal: 40 Marks External: 60 Marks Total: 100 Marks

UNIT-I

Overview of Wireless sensor and actuator networks, comparison of adhoc network, infrastructure network and sensor networks. Introduction to wireless sensor Networks and wireless sensor actuator networks, Terminology WSN architecture, requirements and standards, Topologies uses in Wireless sensor and actuator network.

Employability

Employability

UNIT-II

Applications of wireless sensor networks and wireless sensor actuator networks, , what the challenges ,issues in wireless sensor actuator networks ? requirement for wireless sensor network deployment various standards for WSAN Development of sensor network. Overview of broadcasting techniques, backbone and broadcasting in sensor actuator networks, coverage and connectivity criteria.

UNIT-III

Placement and deployment of sensors in wireless sensor networks. Static sensors and mobile sensors placements.

Placement by Actuators: - **Least Recently Visited Approach, Snake like Deployment Approach, Back Tracking-Deployment Approach**

Different methods used for sensor placement and deployment, Issues with the Wireless sensor network deployment

Sensor Self Depolyment Methods :- Virtual Force/Vector Based Approach, Voronoi Based Approach, Mobile Sensor Migration

UNIT-IV

Multicasting,multirating casting,geo casting and anycasting in sensor network,

Routing in Wireless Sensor and Actuator Networks : flooding,gossiping,classification of routing protocols, Study of types of routing protocols used in wireless sensor network.

Routing protocols based on network structures :- Flat networks routing – directed diffusion,SPIN,Rumor,GBR hierarchicial networks routing :- LEACH,PEGASIS,TEEN routing,location based routing :- Greedy,Face,Geographic adaptive fidelity, Geographic and energy aware routing.

Employability

UNIT-V

Sink Mobility :- Data gathering in deplay tolerant Wireless Sensor Networks : - Sink tour and RP based data collection methods : Direct contact data collection,Rendezvous based data collection,Introduction to sink mobility, energy problems, **Topology Control in Sensor, Actuator : - use of MST and LMST** , Introduction and detection of critical nodes and links : how to identify the critical nodes and links,how to solve the problem of critical nodes and critical links.

Text Books:

1.Wireless Sensor and Actuator Networks Algorithms and Protocols for Scalable Coordination

and Data Communication, Edited by Amiya Nayak and Ivan Stojmenovic A JOHN WILEY & SONS, INC., PUBLICATION,2010.

2. Wireless Communications & Networks, 2nd Edition, William Stallings ,Pearson Education India,2009 3. Wireless Sensor Networks: An Information Processing Approach,Feng Zhao and Leonidas Guibas ,Morgan Kauffman Publication,2004

MTCST115 Advance Operating System

Instruction: 3 Periods/week Time: 3 Hours Credits: 4

Internal: 40 Marks External: 60 Marks Total: 100 Marks

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UNIT-I Process Synchronization: Functions of an operating system, Design approaches, why advanced operating system, Types of advanced operating systems, synchronization mechanisms- concept of a process, concurrent processes, the critical-section problem, other synchronization problems, language mechanisms for synchronization. **Process Deadlocks:** Preliminaries, models of deadlock, models of resources, graph-theoretical model of a system state, necessity conditions for a deadlock, system with single-unit resources and reusable resources.

Employability

UNIT-II Distributed Operating Systems: Architecture of a Distributed Systems, system architecture types, issues in distributed operating systems, communication networks, and communication primitives. Limitations of distributed systems, Lamport's logical clocks, vector clocks, casual ordering of messages, global state. **Distributed Mutual Exclusion:** Introduction, preliminaries, Lamport's Algorithm, Ricart Agrawala Algorithm, generalized non-token based algorithm, token-based algorithm, Suzuki-kasami broadcast algorithm.

Employabilty

UNIT-III Distributed Deadlock Detection: Introduction, preliminaries, deadlock handling strategies, distributed deadlock detection, centralized-deadlock detection algorithms, distributed deadlock detection algorithms, hierarchical deadlock detection algorithms, Agreement protocols-classification solutions-Applications.

Employability

UNIT-IV Distributed Resource Management: Distributed file systems, mechanisms, design issues, distributed shared memory architecture-algorithms-memory coherence, coherence protocols, design issues. Distributed scheduling-issues, components, load distribution, performance comparision.

Employability

UNIT-V Failure Recovery and Fault Tolerance: Recovery-concepts, classifications, error recovery, basic approaches, recovery in concurrent systems, Synchronous and Asynchronous Check pointing and Recovery; Check pointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and

Employability

Nonblocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols.

Text Book:

Advanced Concepts in Operating Systems by Mukesh Singhal and N.G. shivaratri, McGraw Hill, 2000.
Operating System concepts by Abraham Silberschatz, Peter B. Galvin, G. Gagne, sixth edition, Addision Wesley Publishing co., 2003.
Modern Operating Systems by Andrew S. Tanenbaum, Second Edition, Addision Wesley, 2001.

MTCST116 Computer Networks

Instruction: 3 Periods/week Time: 3 Hours Credits: 4

Internal: 40 Marks External: 60 Marks Total: 100 Marks

UNIT- I:

Introduction to Computer Networks: Introduction, Network Hardware, Network Software, Reference Models, TCP / IP protocol suite, Guided and Unguided Transmission media, Understanding of Delay, Loss and Throughput in the packet switching network.

UNIT- II:

Introduction and link layer services, error-detection and correction techniques, Multiple access protocols, Sliding Window Protocols, Multiplexing, Switching, Broad Band ISDN , ATM Networks.

UNIT- III:

Design Issues in Networks: Routing Algorithms, Congestion Control Algorithms, Network Layer in the Internet, IP Protocol, IP Address, Subnets, and Internetworking.

UNIT -IV:

TRANSPORT Service, Elements of Transport Protocols, TCP and UDP Protocols, Quality of Service Model, Best Effort Model, Network Performance Issues.

UNIT-V:

Domain Name System (DNS) , E-mail, FTP,TFTP,WWW ,HTTP,– Multimedia Network Security: Cryptography – Symmetric key and Public Key algorithms - Digital signature –Management of Public keysAdvanced Concepts in Networks: Over View of Cellular Networks, Adhoc Networks, Mobile Adhoc Networks, Sensor Networks, Virtual Private Networks .Delay Tolerant Networks DTN, .

Text Book:

1. Computer Networks, Andrews S Tanenbaum,, Edition 5, PHI, ISBN:-81-203-1165-5
2.Computer Networking Top Down approach 3rd edition By Jim kurose and keith ross
3.Computer networks, Mayank Dave, CENGAGE.
4. Computer networks, A system Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier. 5.Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson.

MTCST117 Network Programming and Web Programming Lab Instruction: 3

Periods/week Time: 3 Hours Credits: 2

Internal: 50 Marks External: 50 Marks Total: 100 Marks

- Part I:

Network programming

1.Identifying well known ports on a Remote System :By trying to listen to the various well known ports by opening client connections. If the exception does not occur then the remote port is active else the remote port is inactive.

2. Writing a Chat application :

i). One-One: By opening socket connection and displaying what is written by one party to the other.

ii). Many-Many (Broad cast): Each client opens a socket connection to the chat server and writes to the socket. Whatever is written by one party can be seen by all other parties.

3. SMTP Client : Gives the server name, send e-mail to the recipient using SMTP

commands. 4.TFTP- Client:To develop a TFTP client for file transfer.

5. HTTP-Server: Develop a HTTP server to implement the following commands. GET, POST, HEAD, DELETE. The server must handle multiple clients.

Part II:

Web Programming

1.Design of the Web pages using various features of HTML and DHTML

2. Design of the Web pages using client side scripting (javascript) for page validation. 3.Client server

programming using servlets and JSP on the server side and java script on the client side. 4. Multimedia

effects on web pages design using Flash

<u>References</u>

1. Java Network Programming, Harol, Orielly Publications

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES

(AUTONOMOUS)

M. Tech I/II CST SEMESTER

Subject code: MTCST119 SEMINAR Practical Time: 3 Hours

Skill Development

Credits:2 Total: 100 Marks

Purpose: To enable a student to be familiar with Communication skills and to make them learn about technical writing skills. Student is expected to Learn

a. How to Make a Presentation

I. Verbal

II.Non Verbal

III. LCD based Power Point

b. How to write a report

I. Abstract

II. Body

III. Conclusions

IV. Executive Summary

c. Communication

Students will be Given a Topic of Importance and are expected to Present the Topic Verbally in 45minutes + Question Answering

To Present the Topic as a Report

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ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES

(AUTONOMOUS)

M. Tech I/II CST SEMESTER -II

Syllabus

Subject code: MTCST121 Machine Learning

Instruction: 3 Periods/week Time: 3 Hours Credits: 4 Internal: 40 Marks External: 60 Marks

Total: 100 Marks

_ UNIT I:

Introduction: Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning**Concept learning and the general to specific ordering** – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.

UNIT II: Decision Tree learning: Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis Space search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in decision tree learning

Employability

UNIT III: Bayesian learning: Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm

Employability

UNIT IV: Computational learning theory : Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces.**Instance-Based Learning**- Introduction, k -Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning

Employability

UNIT V: Learning set of Rules: Introduction, Sequential Covering Algorithms, Learning and Learning Set of First Order Rules.Machine Learning and its Application, case studies such as classification, clustering, prediction .

Employability

TEXT BOOK:

1. Machine Learning ,Tom M. Mitchell, MGH,1997

REFERENCE BOOK:

1. Machine Learning, An Algorithmic Perspective, Stephen Marsland, Taylor & Francis(CRC) 2.

Introduction to Machine Learning, Ethem Alpaydin, PHI, 2004.

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES

(AUTONOMOUS)

M. Tech I/II CST SEMESTER -II

Syllabus

Subject code: MTCST122 Data Ware Housing & Data Mining

Instruction: 3 Periods/week Time: 3 Hours Credits: 4
Internal: 40 Marks External: 60 Marks Total: 100 Marks

_ UNIT – I

Introduction to Data Mining: Evolution of I T into DBMS, Motivation and importance of Data Warehousing and Data Mining,Kinds of Patterns, Technologies, Basic Data Analytics: Data Objects and Attributes Types, Statistical Descriptions of Data, Data Visualization, Estimating Data Similarity and Dissimilarity, Major Issues in Data Mining., Data Mining Applications

Data Warehouse and OLAP Technology: Basic Concepts of Data warehouse, Data Modeling using Cubes and OLAP, DWH Design and usage, Implementation using Data Cubes and OLAPs, Data Generalization with AOI.

UNIT – II

Employability

Data Mining Primitives & Data Cubes: DataMining Primitives, Data Mining Tasks, Data Mining Query Language, DesigningGraphical user Interfaces based on aData Mining Query language, Preliminary Concepts of Data Cube Computation, Data Cube Computation Methods: Multi-way Array Aggregation for Full Cube, BUC Computing for Iceberg Cubes, Star-Cubing Using Dynamic Star-Tree Structure, Pre
computing Shell Fragments for Fast High-Dimensional OLAPs.

Data Mining Concept Description:: Data Preprocessing: Pre-processing the Data, Data Cleaning, Data Integration, Data Reduction, Data Transformation, Discretization and Concept Hierarchy Generation; **Data** Architectures of Data Mining Systems; Characterization and Comparison, Concept Description, Data Generalization and Summarization; Analytical Characterization: Analysisof AttributeRelevance, Mining Class Comparisons, Discriminating between Different Classes, Mining Descriptive & Statistical Measures in Large Databases.

UNIT – III

Mining Frequent Patterns Based on Associations and Correlations: Basic Concepts, Frequent Itemset Mining Methods: Apriori Algorithm, Association Rule Generation, Improvements to A Priori, FP Growth Approach, Mining Frequent Patterns using Vertical Data Formats, Mining Closed and Max Patterns, Pattern Evaluation Methods

Employa

UNIT – IV

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy Advanced Methods: Classification by Back Propagation, SVM, Associative Classification, Lazy Learning, Fuzzy Sets, Rough Sets, Genetic Algorithms, Multiclass Classification, Semi-Supervised Classification

UNIT – V

Cluster Analysis: Basic Concepts, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Evaluation of Clustering Solutions.

Text Book:

1. Data Mining- Concepts and Techniques by Jiawei Han, MichelineKamber and Jian Pei –Morgan Kaufmann publishers –--3rd edition
2. Introduction to Data Mining, Adriaan, Addison Wesley Publication
3. Data Mining Techniques, A.K.Pujari, University Press Data mining concepts by Tan, Steinbech, and Vipin Kumar - Pearson Edu publishers
4. Data Mining –Introductory and Advanced by Margarett Dunham -- Pearson Education publishers
5. Data Warehousing for Real –world by Sam Annahory-- Pearson Education publishers **6.** Web Data Mining and Applications in Business Intelligence and Counter Terrorism, BavaniThuraisingham, CRC Press, June 2003

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)
M. Tech I/II CST SEMESTER

Syllabus

MTCST123 HIGH PERFORMANCE COMPUTING WITH CUDA

Instruction: 3 Periods/week Time: 3 Hours Credits: 4
Internal: 40 Marks External: 60 Marks Total: 100 Marks

UNIT 1 INTRODUCTION: GPUs as Parallel Computers, Architecture of a Modern GPU, Why More Speed or Parallelism? Parallel Programming Languages and Models.

Skill Development

(Text Book 1)

UNIT 2 HISTORY OF GPU COMPUTING : Evolution of Graphics Pipelines ,The Era of Fixed-Function Graphics Pipelines, Evolution of Programmable Real-Time Graphics, Unified Graphics and Computing Processors , GPGPU: An Intermediate Step, GPU Computing , Scalable GPUs, Recent Developments, Future Trends.

Employability

(Text Book 1)

UNIT 3 INTRODUCTION TO CUDA: Data Parallelism, CUDA Program Structure A Matrix–Matrix Multiplication Example, Device Memories and Data Transfer, Kernel Functions and Threading. CUDA Thread Organization Using blockIdx and threadIdx, Synchronization and Transparent Scalability , Thread Assignment, Thread Scheduling and Latency Tolerance

Employability

(Text Book 1)

UNIT 4 CUDA MEMORIES & PERFORMANCE CONSIDERATIONS:
Importance of Memory Access Efficiency, CUDA Device Memory Types , A Strategy for Reducing Global Memory Traffic, Memory as a Limiting Factor to Parallelism, More on Thread Execution ,Global Memory Bandwidth ,Dynamic Partitioning of SM Resources , Data Pre fetching Instruction Mix , Thread Granularity , Measured Performance

Employability

(Text Book 1)

UNIT 5 PARALLEL PROGRAMMING & COMPUTATIONAL THINKING :
Goals of Parallel Programming , Problem Decomposition, Algorithm Selection ,Computational Thinking, **CASE STUDIES**: High Performance Linear ,Algebra**, Design of parallel algorithms :**Odd-Even Transposition sort, quick sort ,bitonic sort ,Graph Analytics, N-body problems, **GPU-Super Computer Acceleration of Pattern Matching.**

(Text Books 1,2,3)

Employability

TEXT BOOKS:

1) Programming Massively Parallel Processors A hands-on Approach By David B. Kirk and Wen-mei W. Hwu, Morgan Kaufmann, 2010.
2) Introduction to High Performance Scientific Computing, Victor Eijkhout, Edmond Chow, Robert van de Geijn ,2nd edition 2014.
3)GPU Computing Gems, **Wen-mei W. Hwu,** Emerald Edition , Morgan Kaufmann Publishers 2011,

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)
M. Tech I/II CST SEMESTER

Syllabus

Subject code: MTCST124

Information Security and Management Systems

Instruction: 3 Periods/week Time: 3 Hours Credits: 4 Internal: 40 Marks External: 60 Marks Total: 100 Marks

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UNIT I Threat analysis: Basic security terminologies, Understanding the threat environment, security goals, compromises, countermeasures, Need for security, Threats, Attacks, Types of Attacks, Employee and ex-employee threats- why employees are dangerous, employee sabotage, employee hacking, employee financial theft and theft of intellectual property, employee computer and internet abuse, data lose, other internal attacks; Malware and malware writers; virus; Trojan horses and rootkits.

EMPLOYABILITY

(Text Book-1)

UNIT II Risk management: Risk, Types of Risks ,Risk analysis- reasonable risk, Classic risk calculations, problem with classic risk analysis, responding to risk; Risk Management: Overview of Risk Management, Risk Identification- Business Risks, Risk Management Models, Risk Assessment, Risk Control Strategies, Quantitative and Qualitative Risk Management Approaches

EMPLOYABILITY

EMPLOYABILITY

EMPLOYABILITY

(Text Book-5)

UNIT III Security Technologies: Firewalls– Processing modes, Categorization, Architectures, Selection and management of the firewalls. Intrusion Detection and Prevention Systems (IDS & IPS), Protecting Remote Connections – Virtual Private Networks for security, Physical Security

EMPLOYABILITY

(Text Book-3)

UNIT IV Information Security Standards: Information Security Policy, Standards, and Practices, Policy Management, Information Security Blue print, ISO/IEC 27001:2005, Design of Security Architecture, Security Education, Training, and Awareness Program,

EMPLOYABILITY

(Reference -5)

UNIT V **Implementation of Information Security**: Information Systems Security Certification and Accreditation. Cryptography techniques –asymmetric and symmetric key cryptosystems introduction. Information Security Maintenance: Maintenance models, Digital Forensics. Overview of ISO 17799/ISO 27001 Standards.

EMPLOYABILITY

(Reference -6)

TEXT BOOKS:

1. Corporate Computer Security, 4th Edition, by Randall J. Boyle (Author), Raymond R. Panko (Author)
2. Principles of Information Security. Michael E. Whitman, Herbert J. Mattord, Cengage Learning, 4th edition.

3. **The Essentials of Risk Management** by Michel Crouhy and Dan Galai Robert Mark(Professional Finance and Investment) Second Edition

4. Information Systems Security, Nina Godbole, Wiley Publishers, India, 2009

5. Corey Schou and Dan Shoemaker, Information assurance for the enterprise: a roadmap to information security, TMH, 2007

REFERENCES:

1. Slay, J. and Koronios, A. (2006) IT Security and Risk Management, Wiley
2. Information Security Policies, Procedures, and Standards: Guidelines for Effective Information Security Management (Paperback) AUERBACH; 1 edition
3. Microsoft Security Risk Management Guide
4. Risk Management Guide for Information Technology Systems http://csrc.nist.gov/publications/nistpubs/800-30/sp800-30.pdf
5. Guide lines for Patch and Vulnerability Management Programme http://csrc.nist.gov/publications/nistpubs/800-40-Ver2/SP800-40v2.pdf

6. Incident Response and Computer Forensics. Chris Prosise and Kevin Mandia. McGraw- Hill (2003).

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES

(AUTONOMOUS)
M. Tech I/II CST SEMESTER

Syllabus

Elective-II

Subject code: MTCST125 Cloud Computing

Instruction: 3 Periods/week Time: 3 Hours Credits: 4 Internal: 40 Marks External: 60 Marks

Total: 100 Marks

UNIT-I

Introduction to cloud computing - distributed computing, centralized computing, grid computing, cluster computing, what is intranet and internet.
What's cloud computing, History of cloud computing, , Benefits of cloud computing, Service models, Deployment models. Current issues and challenges of cloud computing
Cloud Computing Basics - Cloud Computing Overview, Six Phases of Computing Paradigms, cloud

Computing architecture, Applications

UNIT-II

Hardware and Infrastructure– Clients:-Mobile,Thick,Thin, **Security**:- Data Leakage, Offloading work,Logging,Forensics, Compliance VPNs,Key management **,Network**- four different levels : Basic Public Internet, The Accelerated Internet, Optimized Internet Overlay Site-to-Site VPN, **Services** : - identify,integration,mapping,payment,search. **Accessing the Cloud** - Platforms, Web Applications, Web APIs,Web Browsers.

EMPLOYABILITY

UNIT-III

Cloud Services : - Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS),Software plus services - Overview, Cloud computing applications and business case for going to the cloud, **Infrastructure as a Service**--Amazon EC2, **Platform as a Service**—RightScale, Salesforce.com ,**Software as a Service**--Google App Engine and Salesforce , --Microsoft's take on SaaS is slightly different with their Software plus Services (sometimes they shorten it to S+S) Software plus Services **,** how applications help business –operational benefits and economical benefits.

EMPLOYABILITY

UNIT-IV

Cloud Storage and data storage security: - what is cloud storage? uses of cloud storage, Types of cloud storage, things looked for cloud storage, infrastructure, data types used in cloud computing, Data security challenges, VPN- Virtual Private Network ,FADE – File assured deletion ,TPA – Third Party Auditing. Cloud Security – need for security and privacy in cloud computing, Security and privacy issues,

EMPLOYABILITY

UNIT-V

Local Clouds,Thin Clients,Thick clients – Types of Virtualizations,Virtualization in Your Organization, Server Solutions, Thin Clients,
Migrating to the Cloud - Cloud Services for Individuals, Cloud Services Aimed at the Mid-Market, Enterprise-Class Cloud Offerings, Migration, Best Practices and the Future of Cloud Computing - Analyze Your Service, Best Practices, How Cloud Computing Might Evolve.

EMPLOYABILITY

Text Books:

Cloud Computing-A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. McGrawHill.

The Basics of Cloud Computing , Derrick Rountree and Ileana Castrillo

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES

(AUTONOMOUS)
M. Tech I/II CST SEMESTER

Syllabus

Elective-II

Subject code: MTCST125 Mobile Computing

Instruction: 3 Periods/week Time: 3 Hours Credits: 4 Internal: 40 Marks External: 60 Marks Total: 100 Marks

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UNIT-I

Introduction: Wireless transmission, Frequencies for Radio Transmission, Signals, Antennas, Signal Propagation, Multiplexing, Modulations, Spread Spectrum, MAC SDMA, FDMA, TDMA, CDMA, Cellular Wireless Networks.

UNIT-II

Telecommunication Systems: GSM, GPRS, Capacity Allocation: FAMA and DAMA, Broadcast Systems: Digital audio broadcasting (DAB), Digital video broadcasting (DVB), CDMA and 3G.

UNIT-III

Wireless LAN: IEEE 802.11, Architecture, Services, MAC-Physical Layer, IEEE 802.11a- 802.11b Standards, Bluetooth.

UNIT-IV

Routing Adhoc Network Routing Protocols: Adhoc Network Routing Protocols, Destination Sequenced Distance Vector Algorithm, Cluster Based Gateway Switch Routing, fish-eye state routing, Dynamic Source Routing, Adhoc on-demand Routing, Location Aided Routing, Zonal Routing Algorithm. Mobile IP, Dynamic Host Configuration Protocol, Traditional TCP-Classical TCP Improvements-WAP, WAP 2.0

UNIT-V

Publishing & Accessing Data in Air: Pull and Push Based Data Delivery models, Data Dissemination by Broadcast, Broadcast Disks, Directory Service in Air, Energy Efficient Indexing Scheme for Push Based Data Delivery.

Mobile Transaction and Commerce: Models for Mobile transaction, Kangaroo and Joey Transactions, Team Transaction. Recovery Model for Mobile Transactions. Electronic Payment and Protocols for Mobile Commerce.

Text Books:

1. Jochen, M Schiller, “Mobile Communications, 2nd Edition Pearson Education, India, 2009.
2. Kurnkum Garg “Mobile Computing”,Pearson 2010
3. Asoke K Talukder,Roopa R Yavagal, “Mobile Computing”, TMH 2008
4. Raj Kamal,”Mobile Computing”, Oxford, 2009.

Reference Books:

1. William Stallings, Wireless Communications & Networks, 2nd Edition, Pearson 2. Mike Gallegher, Randy Snyder, “Mobile Telecommunications Networking with IS-41”, McGraw Hill 1997.
3. Yi-Bing Lin and Imrich Chlamtac, Wireless and Mobile Network Architecture, Wiley
4. Vijay Kumar, Mobile Database Systems, Wiley

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)
M. Tech I/II CST SEMESTER

Elective – II

Syllabus

Subject code: MTCST125 Soft Computing

Instruction: 3 Periods/week Time: 3 Hours Credits: 4
Internal: 40 Marks External: 60 Marks Total: 100 Marks: 100

UNIT-I

FUNDAMENTALS OF NEURAL NETWORKS: Basic concepts of Neural Network, Human Brain, Model of an Artificial Neuron, Neural Network Architectures, Characteristics of Neural Networks, Learning Methods, Taxonomy of Neural Networks Architectures, History Of Neural Networks, Early Neural Network Architectures and Applications

Employability Skill

UNIT-II

BACKPROPAGATION NETWORKS: Architecture of a Back Propagation Network, Back Propagation Learning, Effective of Tuning Parameters of the Back Propagation Neural Network, selection of Various Parameters of BPN, Research Directions, Applications.

UNIT-III

Employability Skill

ADAPTIVE RESONANCE THEORY: Introduction, ART1: Architecture, Special Features, Algorithm, Illustration, ART2: Architecture, Algorithm, Illustration, Applications

UNIT IV

FUZZY SET THEORY: Fuzzy Versus Crisp, Crisp Sets, Fuzzy Sets, Crisp Relations, Fuzzy Relations

FUZZY SYSTEMS: Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule based System, Defuzzification Methods, and Applications

Employability Skill

UNIT V

FUNDAMENTALS OF GENETIC ALGORITHMS: History, Basic Concepts, Creation of Offspring, Working Principle, Encoding, Fitness Function, Reproduction

GENETIC MODELLING: Inheritance Operators, Cross Over, Inversion and Deletion, Mutation Operator, Bit

Wise Operators and used in GA, Generational Cycle, Convergence of Genetic Algorithm, Applications, Multi-Level Optimization, Difference and Similarities between GA and [illegible]hods, Advances in GA.

Employability Skill

TEXT BOOKS:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.**(Refer PART-I AND PART-II in this Book)**

REFERENCE BOOKS:

1. Neural Networks: A Comprehensive Foundation by Simon Haykin- PHI Publication.
2. Neural Networks – James A Freeman and Davis Skapura, Pearson Education, 2002.
3. Neural Engineering by C.Eliasmith and CH.Anderson, PHI
4. Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.
5. Fuzzy Logic¨Intelligence, Control and Information by John Yen and Reza Langari- Pearson Publication.

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)
M. Tech I/II CST SEMESTER

Syllabus

Elective-II

Subject code: MTCST125 Big Data Analysis

Instruction: 3 Periods/week Time: 3 Hours Credits: 4 Internal: 40 Marks External: 60 Marks

Total: 100 Marks

UNIT I - Introduction to Big Data: Big Data and its Importance - Four V's of Big Data - Drivers for Big Data - Introduction to Big Data Analytics - Big Data Analytics applications.

Employability

UNIT II - R and Hadoop: Features of R language, Hadoop features, HDFS and MapReduce Architecture. **Hadoop MapReduce Programs:** Basics of MapReduce, Hadoop MapReduce Scenario, limitations of MapReduce, MapReduce objects, Hadoop MapReduce example.

Employability

UNIT III - Integrating R and Hadoop: Introducing RHIPE, architecture of RHIPE, RHIPE samples, Understanding the RHIPE function reference, RHadoop.

Employability

UNIT IV - Hadoop Streaming with R: run Hadoop streaming with R, Exploring the Hadoop Streaming R package. **Data Analytics with R and Hadoop:** the data analytics project life cycle, data analytics problems, computing the frequency of stock market change, case study.

Employability

UNIT V - Big Data Analysis with Machine Learning: Introduction to machine learning, Supervised and unsupervised machine learning Algorithms. **Importing and Exporting Data from Various DBs:** data files as database, MySQL, Excel, MongoDB, SQLite, PostgreSQL, Hive, Hbase,

Employability

REFERENCES:

1. Vignesh Prajapati ,"Big Data Analytics with R and Hadoop", 2013 Packt Publishing. 2. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", IBM Corporation, 2012.
3. Michael Minelli, Michehe Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", Wiley CIO Series, 2013.
4. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'Reilly, 2012.
5. Kevin Roebuck, "Storing and Managing Big Data - NoSql, Hadoop and more: High-Impact Strategies - What You Need to Know", Tebbo, 2011.
6. Bill Franks, "Taming The Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", 1st Edition, Wiley and SAS Business Series, 2012.

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES

(AUTONOMOUS)
M. Tech I/II CST SEMESTER

Syllabus

Elective-III

Subject code: MTCST126 Approximation Algorithms

Instruction: 3 Periods/week Time: 3 Hours Credits: 4 Internal: 40 Marks External: 60 Marks Total: 100 Marks

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Syllabus

Employability

Unit 1: The Greedy Algorithm, Layering, Application to shortest superstring, Metric Steiner Tree, MST Based algorithm, Metric TSP, A simple factor 2 algorithm, Improving the factor to 3/2. Example problems. (Chapters 2 and 3)

Employability

Unit 2: The mutliway cut problem, Minimum K-cut problem. Parametric pruning applied to metric K center, the weighted version, Cyclomatic weighed graphs, layering applied to feedback vertex set. Example problems.
(Chapters 4, 5 and 6)

Employability

Unit 3: An FPTAS for Knapsack, Strong NP-hardness and existence of FPTASs. Bin Packing, An asymptotic PTAS. Application: Constrained Shortest Paths, Directed Steiner Trees or Geometric PTASs (polynomial time approximation schemes). Example problems.
(Chapters 8 and 9)

Employability

Unit 4: Factor 2 algorithm, A PTAS for minimum makespan, Bin packing with fixed number of object sizes, Reducing makespan to restricted bin packing. Euclidean TSP The algorithm, Proof of correctness, LP duality theorem, Min-Max relations and LP duality. Two fundamental algorithm design techniques, A comparison of the technique and the notion of integrality gap. Example problems.
(Chapters 10, 11 and 12)

Unit 5: Set Cover via dual fitting: Dual fitting based analysis for the greedy set cover algorithm, generalization of set cover, dual fitting applied to constrained set multicover. Rounding applied to set cover: A simple rounding algorithm, Randomized rounding, half integrality of vertex cover. Example problems.
(Chapters 13 and 14)

Employability

Text Book: "Approximation Algorithms" by Vijay V Vazirani.
Online version at: http://www.cc.gatech.edu/fac/Vijay.Vazirani/book.pdf
Refereed Chapters from this book is an indicative only.

References:

1. The Design of Approximation Algorithms by David Williamson and David Shmoys 2. Geometric Approximation Algorithms by Sariel Har-Peled, First Edition, 2011.

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)
I/II M. Tech(CST) SEMESTER-II

MTCST126 INTERNET OF THINGS
(Elective-III)

Instruction: 3 Periods/week Time: 3 Hours Credits: 4
Internal: 40 Marks External: 60 Marks Total: 100 Marks

UNIT- I : Introduction to the Internet of Things

Introduction, WWW, Internet, Network Protocols, History of IoT , About objects/things in the IoT , The identifier in the IoT , Enabling technologies of IoT , About the Internet in IoT

Employability

UNIT-II : Radio Frequency Identification Technology , Applications and Related Research Issues

Introduction , Principle of RFID , Components of an RFID system , Issues , Introduction , Concepts and terminology , RFID applications , Ongoing research projects ,

Employability

UNIT – III : Wireless Sensor Networks: Technology

History and context , The node, Connecting nodes , Networking nodes , Securing communication , Standards and Fora ,

Employability

UNIT – IV Power Line Communication Technology

Introduction , Overview of existing PLC technologies and standards , Architectures for home network applications , Internet of things using PLC technology

Employability

UNIT – V : RFID Deployment for Location and Mobility Management on the Internet

Introduction , Background and related work , Localization and handover management relying on RFID , Technology considerations , Performance evaluation

Employability

IOT – Setting the standards Introduction Standardizing the IoT , Exploiting the potential of RFID, Identification in the IoT , Promoting ubiquitous networking: any where, any when, any what , Safeguarding data and consumer privacy

Employability

REFERENCES: The Internet of Things: Connecting Objects ,Hakima Chaouchi (Editor), ISBN: 978-1-84821- 140-7 , 288 pages, June 2010, Wiley-ISTE

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES

(AUTONOMOUS)

M. Tech I/II CST SEMESTER

Syllabus

Elective-III

Subject code: MTCST126 Visual Computing &Applications

Instruction: 3 Periods/week Time: 3 Hours Credits: 4 Internal: 40 Marks External: 60 Marks Total: 100 Marks

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UNIT-I

Review of graphics systems – Video display devices, Graphics Software; **Output primitives** – Point and line drawing algorithms, Loading the frame buffer, Circle and ellipse generating algorithms; Pixel addressing and object geometry, Filled area primitives, **2D and 3D geometric transformations** – Matrix representations and homogeneous coordinates, Scaling, Translation, Rotation, special type, **Clipping operations** – Line and polygon clipping algorithms.

Employabi

UNIT-II

Representation of Geometry - Parametric Curves, Bezier Curves, B-Splines (degree zero and higher degrees), NURBS, **Tensor Product Surfaces, Triangle Meshes, Subdivision Methods-** Discrete convolution, Lane-Riesenfeld algorithm, Linear (Gaussian) Diffusion

Employability

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Employability

UNIT-III

Digital Image Processing- Digital Image Filtering, Image Enhancement and Restoration, Wiener Filters, Nonlinear Image processing (Median filtering), Image Segmentation, **Image Transforms and applications**- DFT, DCT, KLT, applications, Orthogonal filter bank (Haar basis), DWT, Scale Space, Vector quantization, Gray level and color quantization, **Template matching-**Template matching and case study,

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Optical Flow.

Employability

UNIT-IV

Learning Methods in Vision- Features, Feature extraction and feature selection (SIFT-a case study), **Classifier Learning-** SVM, RBF network, **Dimensionality Reduction**- PCA, LDA

Modeling- Markov Random Fields, HMM, Maximum Entropy Inference and Bayesian Image Analysis.

Employability

Employability

UNIT-V

Case studies- Basic approaches for Face recognition, Optical character recognition, and Object detection in videos.

Employability

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Text Books:

1. Computer Graphics, D. Hearn and M.P. Baker (C Version), Pearson Education.
2. Digital Image Processing, 3/e by Gonzalez, Pearson (2009).

Web Resources:

1. https://graphics.stanford.edu/courses/cs348a-01-winter/Papers/warren-subdivision.pdf
2. http://www.cs.utexas.edu/~grauman/courses/spring2011/

Reference Books:

1. Computer Graphics: a Programming Approach by Steven Harrington, McGraw-Hill. 2. FUNDAMENTALS OF DIGITAL IMAGE PROCESSING (English) 2nd Edition, Anil K. Jain, Phi Learning 3. Computer Vision: Algorithms and Applications, by R. Szeliski, Springer

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES

(AUTONOMOUS)

M. Tech I/II CST SEMESTER

Syllabus

Elective - III

Subject code: MTCST126 Software Metrics & Quality Assurance

Instruction: 3 Periods/week Time: 3 Hours Credits: 4 Internal: 40 Marks External: 60 Marks Total: 100 Marks

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UNIT-I

What Is Software Quality: Quality: Popular Views, Quality Professional Views, Software Quality, Total Quality Management and Summary. **Fundamentals Of Measurement Theory:** Definition, Operational Definition, And Measurement, Level Of Measurement, Some Basic Measures, Reliability And Validity, Measurement Errors, Be Careful With Correlation, Criteria For Causality, Summary. **Software Quality Metrics Overview:** Product Quality Metrics, In Process Quality Metrics, Metrics for Software Maintenance, Examples For Metrics Programs, Collecting Software Engineering Data. **10 hours**

Employability

UNIT-II

Applying The Seven Basic Quality Tools In Software Development : Ishikawa's Seven Basic Tools, Checklist, Pareo Diagram, Histogram, Run Charts , Scatter Diagram, Control Chart, Cause And Effect Diagram. **The Rayleigh Model:**Reliability Models, The Rayleigh Model Basic Assumptions, Implementation, Reliability And Predictive Validity.
10 hours

Skill Development

UNIT-III

Complexity Metrics And Models: Lines Of Code, Halstead's Software Science , Cyclomatic Complexity Syntactic Metrics, An Example Of UNIT Design Metrics In Practice .**Metric And Lessons Learned For Object Oriented Projects:** Object Oriented Concepts And Constructs, Design And Complexity Metrics, Productivity Metrics, Quality And Quality Management Metrics, Lessons Learned For object oriented Projects.
10 hours

Employability

UNIT-IV

Availability Metrics: Definition And Measurement Of System Availability, Reliability Availability And Defect Rate, Collecting Customer Outage Data For Quality Improvement, In Process Metrics For Outage And Availability
Conducting Software Project Assessment : Audit Ad Assessment , Software Process Maturity Assessment And Software Project Assessment , Software Process Assessment A Proponed Software Project Assessment Method.

Employability

10 hours
UNIT-V
Dos And Don'ts Of Software Process Improvement : Measuring Process Maturity, Measuring Process Capability, Staged Versus Continuous Debating Religion, Measuring Levels Is Not Enough, Establishing The Alignment Principle , Take Time Getting Faster, Keep it Simple Or Face Decomplexification, Measuring The Value Of Process Improvement , Measuring Process Compliance , Celebrate The Journey Not Just The Destination. **Using Function Point Metrics to Measure Software Process Improvement: Software** Process Improvement Sequences, Process Improvement Economies, Measuring Process Improvement at Activity Levels.**10 hours**

Employability

Text Book

1.Stephen H Khan: Metrics and Models in Software Quality Engineering, Pearson 2nd edition 2013.

REFERENCES:
1.Norman E-Fentor and Share Lawrence Pflieger." So ftware Metrics". International Thomson Computer Pre ss, 1997.
2.S.A.Kelkar,"Software quality and Testing, PHI Le aring, Pvt, Ltd., New Delhi 2012. 3.Watts S Humphrey,

"Managing the Software Process ", Pearson Education Inc, 2008. 4.Mary Beth Chrissis, Mike Konrad and Sandy Shrum, "CMMI", Pearson Education(Singapore) Pte Ltd, 2003
5.Philip B Crosby, " Quality is Free: The Art of Making Quality Certain ", Mass Market, 1992.

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES

(AUTONOMOUS)

M. Tech I/II CST SEMESTER

Subject code: MTCST127 Knowledge Engineering lab Practical Time: 3 Hours Credits: 2

Internal: 50 Marks External: 50 Marks Total: 100 Marks

Introduction:

The rapid growth of the Web has generated a wealth of information for individuals and organizations, to the extreme of overloading its users with information. This phenomenon has created the pressing need for turning this information into actionable knowledge according to the requirements of each individual. This need represents the major motivation behind the R&D activities of Knowledge Engineering Laboratory (KEL). KEL researchers can combine their efforts to develop knowledge technologies that will enable the efficient, cost-effective and user-adaptive management and presentation of information.The objectives are as follows

Course Objective:

1. Practical exposure on implementation of well known data mining tasks.
2. Exposure to real life data sets for analysis and prediction.
3. Learning performance evaluation of data mining algorithms in a supervised and an unsupervised setting.
4. Handling a small data mining project for a given practical domain.
5. To introduce students to the basic concepts and techniques of Machine Learning. 6. To develop skills of using recent machine learning software for solving practical problems. 7. To gain experience of doing independent study and research

Learning Outcomes:

1. The data mining process and important issues around data cleaning, pre-processing and integration.
2. The principle algorithms and techniques used in data mining, such as clustering, association mining, classification and prediction.
3. basic knowledge about the key algorithms and theory that form the foundation of machine learning and computational intelligence
4. a practical knowledge of machine learning algorithms and methods

List of Programs [All the programs have to implemented in JAVA or R language] 1. Develop an application to implement defining subject area, design of fact dimension table, data mart. 2. Develop an application to implement OLAP roll up, drill down, slice and dice operation

3. Develop an application to construct a multidimensional data.

4. Develop an application to implement data generalization and summarization technique. 5. Develop an application to extract association rule of data mining.

6. Develop an application for classification of data using Decision Tree

7. Develop an application for implementing clustering using any one technique

8. Develop an application for implementing Naïve Bayes classifier

9. Develop an application for implementing KNN

10. Study on various tools used in Data mining and Machine Learning. (ex : WEKA, SCIKIT LEARN)