Anil Neerukonda Institute of Technology & Sciences (Autonomous)
(Affiliated to AU, Approved by AICTE & Accredited by NBA & NAAC with 'A' Grade)
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DVV 1.1.3: **Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution during 2017-18**

Content	PROGRAMME	Page No
Syllabus copy of the courses highlighting the focus on employability/ entrepreneurship/ skill development.		
Year 3 (2017-2018)	Chemical Engineering	**1–105**
	Civil Engineering	**106-199**
	Computer Science Engineering	**200-299**
	Information Technology	**300-415**
	Electronics and Communication Engineering	**416-517**
	Electrical and Electronics Engineering	**518-604**
	Mechanical Engineering	**605-731**
	M.Tech (Control Systems)	**733-751**
	M.Tech (Bio-Technology)	**752-794**
	M.Tech (Soil Mechanics)	**795-830**
	M.Tech (Machine Design)	**831-877**
	M.Tech (Communication Systems)	**878-911**
	M.Tech (Computer Science & Technology)	**912-938**

ENGLISH

(Common for all branches)

CHE 111 **Credits:3**

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

End Exam : 3 Hours End Exam Marks: 60

Course Objectives:

- To improve the language proficiency of the students in English with emphasis on Reading and Writing skills.
- To enable the students to study engineering subjects with greater comprehension & cognizance.
- To strengthen the vocabulary of the students.
- To enable the students to write grammatically correct structures with logical flow.
- To equip the students with the knowledge of different formats of business communication.

Course Outcomes:

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

1. Analyze the structure of the phrases, clauses and sentences
2. Apply his enriched vocabulary to give better shape to his communication skills.
3. Effectively use different formats of business correspondence.
4. Use idiomatic expressions and foreign phrases in his communication.
5. Analyse, interpret and compose meaningful texts.

CO – PO – PSO Matrix:

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

SYLLABUS

UNIT I 10 Periods

Vocabulary **:** One Word Substitutes

Grammar **:** Noun : Noun Phrase, Gerunds

Writing Skills :

2

1) Formal Letter writing – format, style of letter writing and types of letters – complaint, enquiry, requesting quotations, invitation, regret and acceptance.

2) Story Building-Developing a story from the key words, giving a title and describing learning outcomes.

UNIT II 10 Periods

Vocabulary : Foreign phrases or expressions

Grammar : Adjectives : Quantifiers, qualifiers, determiners, nouns as adjectives, verbs as adjectives, adjective phrases

Writing Skills:

1. Technical Report writing – Formal reports and types: Informational reports, Analytical reports and Recommendation reports— Status, feasibility, progress, incident and project.
2. Essay writing.

UNIT III 10 Periods

Vocabulary : Idiomatic expressions- meaning and usage.

Grammar : Articles (concept and function; definite, indefinite and omission of articles)

Writing Skills :

1. Preparation of C.V. and Resume-format, style purpose and objective.
2. Précis- writing technique with suitable title.

UNIT IV 9 Periods

Vocabulary : Phrasal Verbs derived from the following dynamic verbs: Go, Get, Run, Take, Look, Put, Hold, Stand etc.

Grammar : Prepositions or prepositional phrases

Writing Skills :

1. Reading comprehension – questions based on facts, interpretation, logical deduction, vocabulary.
2. E-mail etiquette- format, style and language

UNIT V 9 Periods

Vocabulary : Synonyms and Antonyms (From the text book only)

Grammar : Pronouns: Kinds of pronouns, relative pronouns – who and whom, whose, which verbs – aspects, moods, tenses, direct and indirect speech (active and passive voice), concord, Infinites and verb participles, verb phrase, conditionals – probable, improbable, impossible, If-clause, correction of sentences

TEXT BOOK:

Life through language, Pearson Publication, Delhi

REFERENCE BOOKS:

3

1. G.J.K. Gangal, *A Practical Course for Developing Writing Skill in English,* PHI
2. Mark Lester and Larry Beason, *Handbook of English Grammar &Usage,* Tata McGraw Hill.
3. S.M.Gupta, *Current English Grammar And Usage,* PHI
4. Dr. P. Prasad, Rajendra K Sharma, *The Functional Aspects of Communication Skills,* Katson Books
5. Abul Hashem, *Common errors in English,* Ramesh Publishing House
6. M. Ashraf Rizvi, *Effective Technical Communication,* Tata Mc-Graw Hill
7. Edgar Thorpe & Showick Thorpe, *Objective English,* Pearson

ENGINERING DRAWING

(Common for all branches)

CHE 114 **Credits :3**

Instruction : 1 Theory& 3 Practical Periods/week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks : 60

Course Objectives:

- To increase ability to communicate with people and learn to sketch and take field dimensions.
- To make the student familiar to the drawing practices and convection
- To familiarize the student about various engineering curves used in industry
- To enable the student draft simple engineering components and analyze different views of components.
- To introduce basic Auto CAD skills.

Course Outcomes:

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

1. Draw various engineering curves and understand the basic geometrical constructions.
2. Prepare orthographic projections of points and lines
3. Produce orthographic projections of plane surfaces
4. Draw orthographic projections of solids in various orientations.
5. Prepare isometric projections and understand basics of Computer Aided Drafting.

CO – PO – PSO Matrix:

		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	1	1
	3	2	1	2	2						2		1	1	1
	4	2	1	2	2						2		1	1	1
	5	2	1	2	2	1					2		1	1	1

SYLLABUS

UNIT – I

Introduction to Engineering Drawing & basics of geometrical construction. Construction of conic sections, Construction of cycloidal curves (cycloid, epicycloid, and hypocycloid), involutes (over circles and polygon) & Archimedian spiral.

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 planes – perpendicular planes – oblique planes

UNIT – IV

Projection of solids – Prisms – Cylinder– Pyramids &Cones

UNIT – V

Isometric projections – Plane solids, Combination of solids Demonstration & Practice: Computer aided drafting of lines, planes solids and Dimensioning.

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. Trymbaka Murty, *Computer Aided Engineering Drawing*

PROGRAMMING WITH C LAB
(Common for all branches)

CHEM 117 **Credits:3**
Practicals/week :3 Periods & 1 Tut/Week Sessional Marks :50
End-Exam:3Hrs End-Exam. Marks :50

Course objective:
To enable students to
- Understand the program development steps using compilers.
- Strengthen the problem solving skills using programming techniques.
- Design programs using various control structures.
- Develop programs using structures, unions and files.

Course outcomes:

By the end of the course, student will be able to:	
1.	Gain a working knowledge on programming.
2.	Learn and use the fundamentals of a programming language (such as language-defined data types (int, float, char, double), control constructs (sequence, selection, repetition), program modules (including functions, modules, methods)).
3.	Exhibit the ability to formulate a program that correctly implements the algorithm.
4.	Demonstrate the effective use the programming environment used in the course.

SYLLABUS:
1. Overview
2. Introduction to Unix
3. Data Types, Constants
4. Operators, Expressions
5. Control Structures
6. Arrays & Strings
7. Pointers
8. Functions.
9. Structures & Unions
10. Files

REFERENCE BOOKS:
1.YashwantKanetkar*Let Us C* 5th Edition.
2.V.Rajaraman*Fundamentals of Computers* 4th Edition, PHI 2005.
3.Programming Techniques through C, M.G. V. Murthy, Pearson Education, 2002
4.KRVenugopal, SR Prasad *Mastering C* Tata McGraw Hill.
5.B.W. Kernighan, Dennis M. Ritchie *The C – Programming Language* PHI

WORKSHOP

(Common for all branches)

7

CHE118 **Credits : 2**

Practical / week :3 Sessional Marks : 50

End Exam : 3Hrs End Exam Marks : 50

Course Objectives :

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

Course Outcomes:

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

1. Make different carpentry joints.
2. Make simple fitting jobs.
3. Make simple jobs like funnel, elbow etc. using sheet metal.
4. Understand and build circuits for different types of applications like stair case wiring, series and parallel connections.

CO – PO – PSO Matrix:

		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						1	1			1	1
	3			1						1	1			1	1
	4			1						1	1			1	1

LIST OF EXPERIMENTS

Minimum of three 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

House Wiring
1. Parallel / Series Connection of three bulbs
2. Stair Case wiring
3. Florescent Lamp Fitting
4. Measurement of Earth Resistance

Tin Smithy

1. Taper Tray
2. Square Box without lid
3. Elbow
4. Funnel

8

PHYSICAL CHEMISTRY

(Only for Chemical Engineering)

CHE 124 — **Credits : 3**

Instruction : 3 Periods & 1 Tut/Week — Sessional Marks : 40

End Exam : 3 Hours — End Exam Marks : 60

Course Objectives:

- To understand about the concept of chemical equilibrium and its importance industrial process
- To get an idea about the thermodynamic functions, laws and its applications
- To know about mobility of ions in dilute solutions and its significance in instrumental methods (conductivity meter)
- To inculcate the concept of order and molecularity of various reactions
- To give an idea about phase diagrams of various heterogeneous equilibria

Course Outcomes:

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

1. Apply the principles of laws of thermodynamics in various Industrial Processes and Designing.
2. Develop suitable conditions in reaction equilibria of various Chemical Processes.
3. Identify the changes in heterogeneous systems and understand the role of various physical quantities useful in Chemical Engineering Industry.
4. Adopt suitable catalytic mechanisms to determine kinetic parameters applicable in Chemical Reaction & Bioprocess Engineering
5. Predict the nature of substances and their behaviour by applying advanced electrochemical laws.
6. Implement the various principles for solving the challenges in the field of Chemical Engineering.

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	1	1	1					1			1	1	1
	3	3	1	1	1					1			1	1	1
	4	3	2	2	1					1			1	1	1
	5	3		2						1			1	1	1
	6	3	1	1	1					1			1	1	1

SYLLABUS

UNIT I 12periods

Thermodynamics and Thermo chemistry: First law-Internal Energy, Work and Heat changes, Enthalpy, reversible isothermal expansion of ideal gas, maximum work. Heat capacities at constant pressure and volume, adiabatic expansion of an ideal gas.Heat of Reaction- heat of Formation, Heat of Combustion, Thermo-chemical Laws, effect of temperature on Heat of Reaction.Second law of Thermodynamics, spontaneous processes, Entropy and physical significance of entropy, Entropy change for an ideal gas.Entropy change accompanying phase change, Gibb's Free Energy and applications.

UNITII 8 periods

Chemical Equilibrium: Reversible reactions, Law of Mass action, Homogeneous equilibria in gaseous and liquid systems and simple example of Heterogeneous equilibria,Le-Chatlier principle- applications, Effect of temperature on equilibrium-VantHoff's equation.

UNITIII 10 periods

Liquid state-vapour pressure, effect of temperature, determination of vapour pressure (static and dynamic method) – surface tension, determination by capillary rise method- viscosity, determination (Ostwald's method)

Phase rule: Definition-explanation of terms-Derivation of phases Rule-One component systems (water system)-Two component systems (Ag-Pb& KI-H_2O), Eutectic mixture-its significance.

UNITIV 10 Periods

Chemical Kinetics and Catalysis: Rate of Reaction- Order &Molecularity, determination of order, first order reaction –illustrations, derivation of rate equation Second order reaction – illustrations, derivation of rate equation, pseudo first order and second order reactions-illustrations,Half life period,numerical problems, Catalysis- Types-Homogeneous-Heterogeneous-Enzyme Catalysis-Mechanisms.

UNIT-V 10Periods

Electrochemistry: Electrolytes-Types-Conductance-Specific, Equivalent, Molar conductance – Conductmetric Titrations , measurement of electrical conductivity and numerical problems ,variation of conductance with temperature, Migration of ions , relative speed of ions, Hittrof's rule-transport number, Determination-Hittrof method, Kohlarsauch's law and applications.

TEXT BOOK:

1. ArunBhal, B.S.Bhal and G.D.Thuli, *Essentials of Physical chemistry*, S.Chand and company ltd.

REFERENCE BOOKS:

1. Peter Atkins & Julio de Paula, *Physical Chemistry*, 7^{th} edition, oxford university press
2. B.R.Puri and L.R.Sharma, *Principles of physical chemistry*, 44^{th} edition vishal publishing company, New Delhi.

LANGUAGE LAB
(Common for all branches)

CHE127	**Credits : 2**
Practical / week : 3	Sessional Marks : 50
End Exam : 3Hrs	End Exam Marks : 50

Course Objectives:

- To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
- To facilitate computer-aided multi-media instruction enabling individualized and independent language learning.
- To improve the fluency in spoken English and neutralize mother tongue influence
- To bring about a consistent accent and intelligibility in their pronunciation of English by providing an opportunity for practice in speaking.
- To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.
- To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such GRE, TOEFL, GMAT etc.

Course Outcomes:

By the end of the course, student will be able to:
1. Handle CBT (Computer Based Tests) of the qualifying examinations.
2. Receive, interpret, remember and evaluate information by practicing effective listening skills.
3. Speak English with neutralized accent.
4. Narrate, describe and report incidents and situations using appropriate terminology.

CO – PO – PSO Matrix:

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

SYLLABUS

I CALL (Computer Aided Language Learning)

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Short and long Reading comprehension exercises (listening skills)
4. Telephoning Skills.

II CSL (Communication Skills Lab)

5. 'Just A Minute' Sessions (JAM).
6. Describing Objects / Situations / People.
7 Video talks
8. Situational Dialogues / Role Play.
9. Oral Presentations- Prepared and Extempore.

Suggested Software

Cambridge Advanced Learners' English Dictionary with CD.

English Phonetics and Phonology – 2 CDs set

English Mastery – Alania ABC

Telephoning English

Cambridge Grammar of English (Ronald Carter and Michael McCarthy) CD

English Grammar in Use -Cambridge University Press

Communication Skills – Oxford U P (Sanjay Kumar and PushpaLatha)

REFERENCE BOOKS:

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems)

1. *Spoken English (CIEFL)* in 3 volumes with 6 cassettes, OUP.
2. Daniel Jones, *English Pronouncing Dictionary*, Current Edition with CD.
3. R. K. Bansaland, J.B. Harrison, *Spoken English*-Orient Longman 2006 Ed.
4. Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, *English Language Communication : A Reader cum Lab Manual*, Anuradha Publications, Chennai
5. Krishna Mohan & NP Singh, *Speaking English Effectively* (Macmillan)
6. J. Sethi, KamleshSadanand & D.V. Jindal, *A Practical Course in English Pronunciation, (with two Audio cassettes)* Prentice-Hall of India Pvt. Ltd., New Delhi.
7. T. Balasubramanian, *A text book of English Phonetics for Indian Students* (Macmillan).
8. *English Skills for Technical Students*, WBSCTE with British Council, OL
9. J.K. Gangal, *A Practical Course in Effective English Speaking Skills*, PHI.

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.

Employability

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.

Employability

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.

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**

Employability

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**

Employability

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.

Employability

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.

Employability

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”, 4^{th} ed., McGraw- Hill.
2. J.H.Coulson and J.F.Richardson, “Chemical Engineering -Vol.2” 5^{th} 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”,8^{th} ed., McGraw-Hill Book Co., 2007.
2. Brown et al., “Unit Operations”, 1^{st} ed., CBS Publisher,2005.
3. Badger and Banchero, “Introduction to Chemical Engineering”, 1^{st} 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.

Employability

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.

Employability

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.

Employability

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

Employability

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" 6^{th}ed., 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'", 3^{rd} 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.

Skill development

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.

Skill development

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.

Employability

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

Employability

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.

Employability

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.

Employability

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.

Employability

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.

Employability

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.

Employability

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.

Employability

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.

Employability

UNITIV **12 L + 3T**

Design of Multiple Reactors:

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

Employability

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

Employability

UNITIV **12 L + 3T**

Processing Equipment:

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

Employability

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.

Employability

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.

Employability

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

Employability

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.

Employability

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.

Employability

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.

Employability

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.

Employability

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

Skill development

Prescribed Books
1. W. L. McCabe, J. C. Smith and P. Harriot, *Unit Operations of Chemical Engineering*, 7^{th} 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.

Employability

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.

Employability

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.

Employability

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.

Employability

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.

Employability

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$_3$C-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.

Employability

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.

Employability

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,.

Employability

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.

Employability

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.

Employability

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 $1/3^{rd}$ and $1/8^{th}$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.

Skill development

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*, 2^{nd} edition, 2012, Prentice-Hall.

REFERENCE BOOKS:

1. Steven C Chapra. Raymond P. Canale, *Numerical Methods for Engineers with Personal Computer Applications*, 2^{nd} 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.

Employability

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*, 2nd edition, Technomic Publishing Co(1998).
2. J.D.Seader and Ernest J. Henley , *Separation process principles*,2nd edition, 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.

Employability

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

Employability

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.

Employability

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.

Employability

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

Skill development

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.

Skill development

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

Skill development

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

CHE 411 – Transport Phenomena

PART-A

Momentum transport: Viscosity and the mechanism of momentum transport- i). Newton's law of viscosity, ii). Non-Newtonian fluids and iii). pressure and temperature dependence of viscosity,

Velocity distributions in laminar flow: i). Shell momentum balances boundary conditions, ii). flow of a falling film, iii). flow through a circular tube and iv). flow through an annulus,

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

Velocity distributions with more than one independent variable and unsteady viscous flow,

Velocity distributions in turbulent flow: i). Fluctuations and time-smoothed quantities, ii). time-smoothing of the equations of change for an incompressible fluid and iii). semiempirical expressions for the Reynolds stresses,

Interphase transport in isothermal systems: i) Definition of friction factors, ii). friction factors for flow in tubes and iii). friction factors for flow around spheres,

PART-B

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

Temperature distributions in solids and in laminar flow: i) Shell energy balances-boundary conditions, ii). heat conduction with an electrical heat source, iii). heat conduction with a viscous heat source, iv). heat conduction through composite walls, v). forced convection and vi). free convection,

The equations of change for non-isothermal systems: i). The equation of energy in rectangular and curvilinear coordinates, ii). the equations of motion for forced and free convection in non-isothermal flow, iii). use of the equations of change to set up steady state heat transfer problems and iv). dimensional analysis of the equations of change,

Temperature distribution with more than one independent variable: Unsteady state heat conduction in solids,

Temperature distribution in turbulent flow: i). Temperature fluctuations and the time-smoothed temperature, ii). time smoothing the energy equation and iii). semi empirical expressions for the turbulent energy flux,

Interphase transport in non-isothermal systems: i). Definition of the heat transfer coefficient, ii). heat transfer coefficients for forced convection in tubes and around submerged objects and iii). heat transfer coefficients for free convection,

PART-C

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

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

The equations of change for multicomponent systems: i). The equations of continuity for a binary mixture, ii). the equations of continuity of A in curvilinear coordinates and iii). dimensional analysis of the equations of change for a binary isothermal fluid mixture,

Concentration distributions in turbulent flow: i).Concentration fluctuations and the time smoothed concentration and ii). time-smoothing of the equation of continuity of A,

Interphase transport in multicomponent systems: i). Definition of binary mass transfer coefficients in one phase, ii). correlations of binary masstransfer coefficients in one phase at low mass-transfer rates, iii). definition of binary mass-transfer coefficients in two phases at low mass-transfer rates and iv). definition of the transfer coefficients for high mass transfer rates.

Text book:

1. 'Transport Phenomena' by R. Byron Bird, W.E. Steward and Edwin N. Lightfoot, John Wiley & Sons Inc., New York

Reference books:

1. 'Transport phenomena' by Robert S. Brodkey & Haryr C. Hershey, McGraw Hills Company, New Yark
2. 'Transport Phenomena-for engineers' byLouis Theodore, International Book Compnay, London
3. 'Transport Phenomena' by W.J.Book and K.M.K.Multzall, JW&Sons Ltd.
4. 'Fundamentals of Momentum, Heat and Mass Transfer' by Mames R Welty, Charlese Wicks and Robert E Wilson, J W & Sons Inc., New York
5. 'Fluid Dynamics and Heat Transfer' by James G. Knudsen and Donald L.Katz., McGraw Hills Company Inc., New York.

CHE–412 Chemical Engineering Mathematics

Mathematical formulation of the physical problems: i). Application of the law of conservation of mass, salt accumulation in stirred tank, starting an equilibrium still, solvent extraction in N stages, diffusion with chemical reaction and ii). application of the law of conservation of energy, radial heat transfer through a cylindrical conductor, heating a closed kettle, flow of heat from fin,

Analytical (explicit) solution of ordinary differential equations encountered in Chemical engineering problems: i). First order differential equations, method of separation of variables, equations solved by integration factors, certain examples involving mass and energy balances and reaction kinetics and ii). second order differential equations, non-linear equations, linear equations, simultaneous diffusion and chemical reaction in a tubular reactor, continuous hydrolysis of tallow in a spray column,

Partial differential equations: i). Formulation of partial differential equations, unsteady-state heat conduction in one dimension, mass transfer with axial symmetry, continuity equation, ii). boundary conditions- function specified, derivative specified and mixed conditions and iii). particular solutions of partial differential equation-compounding the independent variable into one variable, superposition of solutions, the method of images and particular solution suggested by the boundary conditions,

Finite differences: i). The difference operator, properties of the difference operator, difference tables, other difference operators, ii). linear finite difference equation, complementary solution, particular solution, simultaneous linear difference equations and iii). non-linear finite difference equations, analytical solutions,

Skill development

Solutions for the following type of problems by finite difference method: a). Calculation of the number of plates required for an absorption column, b). calculation of the number of theoretical plates required for distillation column and c). calculation of number of stages required for a counter current extraction and leaching operation,

Application of statistical methods: i). Propagation of errors of experimental data, ii). parameter estimation of algebraic equations encountered in heat and mass transfer, kinetics and thermodynamics by method of averages, linear least squares and weighted linear least squares methods and iii). design of experiments - factorial and fractional factorial methods.

Text book:

1. 'Mathematical Methods in Chemical Engineering' by V.G.Jenson and G.V.Jeffreys, Academic Press, London

Reference books:

1. 'Applied Mathematics in Chemical Engineering' by Harold S. Mickley, Thomas S. Sherwood and Charles E. Reed, Tata McGraw Hill Publications
2. 'Applied Statistics' 2nd edition by Volk, W., McGraw Hill Chemical Engg. series
3. 'Applied Numerical Methods with Personal Computers, by Alkis Constantinides,S., McGraw Hills, Chemical Engineering series, 1987

CHE–413 Chemical Reaction Engineering – II
(Effective from the admitted batch of 2011-12)

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

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

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

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.

Employability

Noncatalytic 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.

Employability

Text book:

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

Reference books:

1. “Chemical Engineering Kinetics’ by Smith, J.M. 3rd Edition, McGraw Hill Inc.
2. “Elements of Chemical Reaction Engineering” by Fogler, H.S, 3rd Edition, Printice Hall India Ltd.

CHE–414 Industrial Management

Management: Functions of management - Planning, organizing, staffing, directing controlling and coordinating, levels of management, role of Manager, skills of manager, pioneers in management–F.W.Taylors scientific management and Henry Fayol's principles of management,

Organization: Meaning of organization, principles of organization, organization structure, types of organization structures - line organization structure, line and staff organization structure, functional organization structure, committee organization structure and matrix organization structure,

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,

Production operations management: Production **p**lanning and control, **p**lant location and factors affecting plant location, plant layout and types of layout, line or product layout, process or functional layout, fixed position layout and combination layout, work study and method study,

Employability

Human resources management: Basic functions of human resource management: Man power planning, recruitment, selection, training, development, placement, compensation and performance appraisal.

Employability

Text books:

1. 'Industrial Organization & Engineering Economics' by S.C.Sharma & T.R.Banga, Khanna Publishers, Delhi
2. 'Management Science' by A.R.Aryasri, Tata McGraw Hill, Publishers, New Delhi

Reference book:

1. 'Industrial Engineering and Management' by O.P.Khanna, Dhanpat Raj and Sons.

CHE–415 Process Dynamics and Control

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,

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,

Employability

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

Analysis and design of feed –back control systems : Concept of feed back control, types of feed- back controllers, measuring devices, final control elements, dynamic behavior of feed-back control process, block diagram and closed loop response, effect of P.I. & D control action on the response of a controlled process,

Analysis and design of control systems: Cascade control, feed forward control, ratio control,

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

Employability

Text book:

1. 'Process Analysis and Control' 2nd edition by Donald R.Coughnowr, McGraw Hills

Reference books:

1. 'Chemical Process Control- An Introduction to Theory and Practice' by G.Stephanopoulas, Prentice Hall of India Pvt. Ltd., New Delhi
2. 'Computer Control of Industrial Processes' by E.S.Savas, McGraw Hill,London
3. 'Handbook of Instrumentation and Control' by Considine
4. 'Process Modeling Simulation and Control for Chemical Engineers' by Lubin
5. 'Industrial Instrumentation' by Donald P. Eckmen, Wiley Eastern Limited.

CHE–416 Computer Aided Design (Elective-III)

CAD of fluid flow system: Flow of Newtonian fluids in pipes, pressure drop in compressible flow, flow of non-Newtonian fluids in pipes, pipe network calculations, two phase flow system,

CAD of heat transfer equipment: Shell and tube exchangers without phase change, condensers, reboilers, furnaces,

Skill development

CAD of mass transfer equipment: Distillation, gas absorption, liquid extraction,

CAD of chemical reactors: Chemical reaction equilibrium, analysis of rate data, ideal reactor models, non-ideality in chemical reaction, performance analysis using residence time distribution, temperature effects in homogeneous reactors, heterogeneous systems and fluidized bed reactors.

Text book:

1. 'Chemical Process Computation' by Raghu Raman, Elsevier Scientific Publications,

Reference books:

1. 'Fundamentals and Modelling of Seperation Process' by C.D.Holland, Prentice Hall Inc., New Jercey
2. 'Catalytic Reactor Design' by Orhan Tarhan, Mc Graw hills Ltd.
3. 'Chemical Engineering' Volume-6, by Sinnot, Pergamon Press, 1993.

CHE–416 Fluidization Engineering (Elective-III)

Introduction: Phenomena of fluidization, liquid like behavior of fluidized beds, advantages and disadvantages of fluidized beds, different types of fluidized beds, applications of fluidization technique in process industries,

Fixed Bed: Derivation of fixed bed pressure drop equation from fundamental characteristics – Kozeny–Carman equation and Ergun equation, effects of - particle size, sphericity, vesicularity, wall effect, surface roughness and voidage on fixed bed pressure drop.

Minimum fluidization: Derivation for minimum fluidization mass velocity and pressure drop equation for minimum fluidization,

Employability

Fluidization: Types of fluidization– batch, continuous and semi fluidizations, classifications based on particle diameter and movement, pressure drop-flow diagrams for fluidized bed, slugging bed and channeling bed, effects of L/d, fluid distributors, mode of fluidization, power consumption and pumping requirements, hindered and free settlings, stratification, voidage function, fluidization efficiency, fluctuation ratio,

Liquid fluidized beds: Rechardson and Zaki correlation,

Bubbles in dense beds: Single rising bubble, two dimensional Davidson model, stream of bubbles from single source, bubble volume and frequency, bubbles in ordinary bubbling beds and bubbling bed model for the bubble phase,

Emulsion phase in dense bubbling beds: Movement of individual particles, turn over rate of solids, residence time distribution, diffusion model and bubbling bed model,

Terminal velocity: Derivation for terminal velocity,

Entertainment and Elutriation: Definitions, transport disengaging height (TDH), entrainment at or above TDH for single size and size distribution of solids, entrainment below TDH, effects of various parameters, entrainment for an infinite free board and a small free board, parameters effecting elutriation, elutriation rate equation, elutriation of fines,

Flow of high bulk density and low bulk density mixtures: Pressure drops in stick-slip flow and aerated flow and related equations, downward discharge from a vertical pipe, flow in a horizontal pipe, saltation velocity, choking velocity, pressure drop in pneumatic conveying, pressure drop in bends and cyclones in fluidization bed reactors,

Spouted bed: Definition, pressure drop-flow diagram, minimum spouting correlation and effect of various parameters on spouting,

Heat and mass transfer in fluidized beds: Variables affecting heat transfer rate, heat transfer at the wall of containing vessel, heat transfer to immersed tubes, models proposed by i) Wicke-Fetting, ii)Mickley and Fair Banks and iii) Levenspiel and Walton, heat transfer in fixed and fluidized beds, definition and evaluation of mass transfer coefficient.

Employability

Text books:

1. `Fluidization Engineering' by Diazo Kunii,and Ocatve Levenspiel (Chapters1,2,3,4,5,6,7,8,9,10 and 12).
2. `Fluidization' by Max Leva (Chapters 2,3,4,5and 7).

CHE–416 Industrial Pollution and Control Engineering (Elective-III)

Types of emission from chemical industries and their effects on environment, Environmental legislation, noise pollution, occupational health hazards, meteriological factors in pollution dispersion (ALP and ELP), plume behaviour and characteristics, chimney design considerations: Plume raise, effective stack height,

Methods of analysis of air pollutants, particulate matter, SO_x, NO_x, CO_x analysis, removal of particulate matters: principles and design of setting chambers, solid traps, cyclone separators, fabric and design of fibre filters, scrubbers and electrostatic precipitators,

General methods of control and removal of sulphur dioxide, oxides of nitrogen, organic vapors from gaseous effluents with design aspects, sources of waste waters, effluent guidelines and standards, characterization of effluent streams, oxygen demanding wastes, oxygen sag curve, BOD curve, analysis of water pollutants,

Methods of primary treatment: Screening, sedimentation, floatation and neutralization, biological treatment, bacteria and bacterial growth curve, aerobic processes suspended growth processes, activated sludge process, extended aeration, contact stabilization, aerated lagoons and stabilization ponds, attached growth process with design aspects, trickling filters, rotary drum filters, fluidized bed contactors, anaerobic processes,

Employability

Methods of tertiary treatment: Carbon adsorption, ion exchange, reverse osmosis, ultra filtration, chlorination, ozonation & sonozone process, sludge treatment and disposal,

Solid waste management: solid waste collection, transportation, solid waste processing and recovery, hazards in waste management, risk assessment and safety measures, types of hazardous wastes, health effects, safety measures, risk assessment response measures, case studies or pollutants removal and safety measures in fertilizer, petrochemical, paper, pharmaceutical industries and petroleum refinery,

Industrial safety: Why safety, accidents, causes and remedial measures, safety aspects of site selection, plant layout and unit plot planning, hazards of commercial chemical operations and reactions, safety aspects of process design, instrumentation for safe operations, safety aspects in design and inspection of pressure vessels, effect of toxic agents, toxicity vs hazards, respiratory hazards, safe experimentation and testing of reactions, materials for safety,

Employability

Flamable materials: Fire extinguishing agents and their applications, fire safety in chemical processing, personnel protective equipment, permit systems, hazard evaluation techniques, modern safety management systems, safety effectiveness.

Text books:

1. 'Environmental Pollution Control', by C.S. Rao, Wiley Eastern Limited
2. 'Safety and Accident Prevention in Chemical Operations' by Fawcett and Wood

Reference books:

1. 'Environmental Engineering' by Arcdio P.Sincero and Geogoria Sincero
2. 'Loss Prevention in Chemical Industries' by Frank P.Lees

CHE–416 Multi component Separation Processes (Elective-III)

Multi component vapor –liquid equilibria: Ideal mixtures at low pressures, non-ideal mixtures, activity coefficient models - Wilson, NRTL, UNIQUAC and UNIFAC equations, evaluation of model constants from binary experimental data, prediction of multicomponenet VLE from the model constants of the constituent binaries,

High pressure equilibria: Vaporization constants, K, Thermodynamic method for K, graphical charts, chao-Seader correlation,

Equilibrium and Simple Distillation: Multicomponent equilibrium, flash vaporization(EFV), multicomponent differential distillation,

Design considerations in fractionating process: Quantitative relationships, temary and multicomponent system fractionation, key fractionation concepts, selecton of key components, column pressure, material balance, rigorous and approximate minimum reflux calculations, recommended short-cut methods for minimum reflux minimum plates at total reflux, FUG methods, Smith Brinkley method,

Multicomponent fractionation rigorous design procedures: Sorel method, Lewi Metheson method, Thiele-Geddes method and its versions in distillation column design, techniques of separating azeotropic and close boiling mixtures by fractional distillation, azeotropic and extractive distillation, selection of solvents, design considerations, pseudo binary methods, solvent recovery,

Tray design and operation: The common tray types, tray capacity limits, tray hydraulics parameters, flow regies on trays, column sizing, tray efficiency, fundamentals, tray efficiency prediction.

Employability

Packing design and operation: Packing types, packing hydraulics, comparing packings and trays, packing efficiency and scale-up.

Text books:

1. 'Distillation' by M.Van Winkle, McGraw Hill Book Company
2. 'Phase Equilibria in Chemical Engineering' by S.M.Wales, Butterworth publishers, 1985
3. 'Distillation Design' by Henery Z Kister, McGraw Hill Book Company

CHE-416 Biochemical Engineering (Elective-III)

Introduction to Biochemical engineering and Biotechnology: Overall view of biotechnology since its practice–to date, enzyme kinetics, derivation of M.M. equation of single as well as multiple substrates, enzyme inhibition, determination of M.M. parameters, industrial applications of enzymes,

Cell cultivation & kinetics: Microbial, animal and plant cell cultivation, cell immobilization, batch growth of cells, yield coefficient, monod growth kinetics,

Analysis and design of fermenters: Batch fermenter, mixed flow fermenter (chemostat), plug flow fermenter, mixed flow fermenters in series, and cell recycling,

Employability

Genetic engineering: DNA and RNA, cloning of genes, stability of recombinant microorganisms, gene manipulation,

Sterilization: Sterilization of media and air, thermal death kinetics, design criterion, continuous sterilization methods,

Aeration and agitation in fermenters: Correlations of mass transfer coefficient, measurement of interfacial area and gas holdup, power consumption, scale up concepts,

Bioanalytical techniques: Gas chromatography, thin layer and paper chromatography, HPLC, affinity, gel, adsorption and ion exchange chromatography.

Employability

Text book:

1. 'Biochemical Engineering Fundamentals' 2nd edition by J.E.Bailey and D.F.Ollis, McGraw-Hill Publishers, Newyork, 1986

Reference books:

1. 'Chemical Engineering' volume-3, 3rd Edition by J.F Richardson and D.G. peacock, (Chapter-5: Biochemical Reaction Engineering), Pergomon Press, U.K, 1994
2. 'Bioprocess Engineering: Basic Concepts' 2nd edition by M.L.Shuler and F.Kargi, Prentice Hall India, New Delhi, 2003
3. 'Biochemical engineering' by D.G. Rao, Tata McGraw-Hill Publishers, New Delhi,
4. 'Biochemical Engineering' by J.M. Lee, Prentice Hall, Englewood Clifts, 1992.

CHE-416 Reservoir Engineering (Elective-III)

Fundamental concepts of Reservoir Engineering: Possibility, fluid saturation, permeability, flow through layered beds, flow through series beds, Klinkenberg effect, effective permeability data, phase behaviour,

Oil reservoirs: Reservoir driving mechanisms, basic equation and tools, volatile oil reservoirs, identification of volatile oil reservoirs, ultimate recovery, predicting reservoirs behavior, performance, mechanics of reservoir performance, prediction procedure, limitations of predictions, relating reservoir performance to time, factors affecting ultimate recovery, analysis gas oil ratio history,

Water drive reservoirs: Effect of free gas saturation on recovery, predicting reservoirs performance, calculating water influx, use of the unsteady state equation in predicting reservoir performance, validity of performance prediction, limitations in predicting reservoir performance, the material balance equation as a straight line,

Gravity drainage reservoirs: Permeability in the direction dip, dip of the reservoir, reservoir producing rates, oil viscosity, relative permeability characteristics, fundamental recovery process, predicting reservoir performance, apparent relative permeability, oil saturation method,

Employability

Combination of drive reservoirs: Index of drives, equations used, material balance equations, instantaneous gas oil ratio equation,

Pressure maintenance: Pressure maintenance by gas injection, condensing gas drive, predicting performance by gas 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,

Improving oil recovery: Improving oil recovery by fluid immiscible gas–water, miscible fluid injection thermal oil recovery, predicting recovery from fluid injection products, Stiles's method of water flood prediction, derivation of water out and recovery equations, frontal advance techniques for prediction result of either water or gas injection, well arrangements, peripheral water flooding, predicting behavior of peripheral water floods, special consideration involved in water flooding, water flood case history, predicting the results of water flooding.

Text book:

1. 'Reservoir Engineering Manual' – 2nd Edition by Frank W. Cole, Gulf Publishing Company, Houstan, Texas, 1969.

CHE–417 Chemical Reaction Engineering Laboratory

1. Determination of the order of a reaction using a batch reactor and analyzing the data by (a) differential method and (b) integral method
2. Determination of the activation energy of a reaction using a batch reactor
3. To determine the effect of residence time on conversion and to determine the rate constant using a CSTR
4. To determine the specific reaction rate constant of a reaction of a known order using a batch reaction.
5. To determine the order of the reaction and the rate constant using a tubular reactor
6. Determination of RTD and dispersion number in a tubular reactor using a tracer
7. Mass transfer with chemical reaction (solid-liquid system) – Determination of mass transfer coefficient
8. Axial mixing in a packed bed - Determination of RTD and the dispersion number for a packed bed using tracer
9. Langmuir adsorption isotherm - Determination of surface area of activated charcoal.
10. Performance of reactors in series: (i) A plug flow reactor followed by a CSTR and (ii) A CSTR followed by a plug flow reactor.

Skill development

CHE-418 Process Dynamics and Control Laboratory

1. Response of mercury-in glass thermometer
2. Response of mercury-in glass thermometer with thermal well.
3. Calibration & response of resistance thermometer
4. Response of manometer
5. Calibration of thermocouples
6. Response of single-tank liquid level system
7. Response of two-tank non-interacting liquid level system
8. Response of two tank interacting liquid level system
9. Study of on-off control – Control let off position.
10. Valve characteristics of equal % control valve
11. Valve characteristics of linear control valve
12. On-off control – controller on position
13. Studies on hysteresis characteristics of Bourdon pressure gauze
14. Hysteresis characteristics of equal % control valve
15. Studies on hysteresis characteristics of linear control valve
16. Response studies for different types of controller (P, PI, PID) using PID control trainer.
17. Level control trainer
18. Pressure control trainer
19. Temperature control trainer

Skill development

CHE-419 Seminar

CHE-420 Viva-voce on Industrial Training Report

Skill development/Employability

CHE-421 Chemical Process Equipment Design

Introduction of plant design and costs,

Process design development: Design project procedure, design information from the literature and other sources of information, flow diagrams, preliminary design, comparison of different processes, firm process design, equipment design and specialization, scale up in design, safety factors specifications, materials of construction,

General design considerations: Health and safety hazards, fire and explosion hazards, personnel safety, loss prevention, thermal pollution control, noise pollution and control, plant location, plant layout, plant operation and control, utilities, structural design, storage, materials handling, materials and fabrication selection.

Material transfer, handling and treatment equipment design and costs: Incompressible fluid flow systems design, flow through parallel, series and piping network systems, compressible fluid flow systems design, design and cost estimation of filters.

Mechanical design of process equipment: Design and selection of storage vessels and low pressure vessels, design of roofs, bottom plates, formed heads, flat plate and conical closures, tall vertical columns, supports to process vessels, distillation columns, heat exchanges, evaporators.

Employability

Heat transfer equipment design and costs: Heat exchangers for sensible heat exchange - double pipe, shell and tube, plate heat exchangers, heat exchangers with extended surface, optimum heat exchanger design, heat exchangers with phase change – single effect evaporators, multiple effect evaporators, vapor recompression evaporators, condensers – condensation of single vapors, condensation with boiling range, reboilers.

Employability

Mass transfer equipment design: Continuous distillation- design for binary systems and pseudo binary systems for multi component distillation, plate efficiencies, entrainment, approximate column sizing, selection of plate type, plate construction, plate hydraulic design, plate design procedure, plate areas, diameters, liquid flow arrangements, entrainment, weep point weir dimensions, perforated area, hole size, hole pitch, hydraulic gradient, liquid flow, plate pressure drop, down comer design, packed columns - choice of plate or packing, types of packing, packed bed height, prediction of height of transfer unit (HTU) liquid distribution, stimulation of pressure drop in packed towers, allowable velocities, column diameter, column internals, wetting rates, reactor design, equations for reactor design application - batch reactor, tubular flow reactor, back mix reactors expression of reaction rates mechanical features of reactor design.

Text books:

1. 'Plant design & Economics for Chemical Engineers', 4th edition, M.S.Peters & K.D.Timmerhaus, Mc Graw Hills Publishing Company
2. 'Process Equipment Design', 3rd Edition, M.V.Joshi, MacMillan India Ltd 1981

Reference books:

1. 'Process-Plant-Design' by J.R.Backhurst & J.H.Harker, Heieman Education London
2. 'Chemical Engineering' Volume-VI (An introduction to Chemical Engineering Design' by J.M.Coulson & J.F.Richardon

CHE-422 Process Optimization (Elective-IV)

Monotonic function, unimodal function, stochastic process, deterministic process, convex and concave sets, feasible and infeasible regions, state and control variables, Lagrange multipliers, saddle point, sensitivity analysis, iterative rule, slake variable principle of optimality, design constraints, constraint surface, objective function, classification of optimization problems, basic and non-basic variables, functions of one variables, methods based on interval of uncertainty, sequential search methods, quadratic interpolation, qubic interpolation, regular Falsi technique,

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Non–linear programming, unconstrained optimization techniques, univarient methods, functions of several variables, alternate variable search method, exploratory and pattern moves method, conjugate gradient method, quasi Newton methods, variable metric method, Powell's method, Newton-Raphson method,

Skill development

Constrained optima, pivot operation, linear programming, simplex method, revised simplex method, dual relations, dual simplex method, decomposition principle, changes in the right hand side constraints, changes in the cost coefficients, addition of constraints, Kuhn Tucker conditions,

Polynomial: Solution of an unconstrained geometric programming problem, solution of a constrained geometric programming problem, dynamic programming, multi-stage optimization, stochastic dynamic programming, integer linear programming, integer non-linear programming, network problems, CPM and PERT methods, transportation problems.

Text books:

1.'Optimisation Theory and Applications' by S.S.Rao, 2nd edition, Wiley Eastern Limited
2. 'Optimisation Techniques for Chemical Engineers' by Asghar Hussain and Kota Gangiah
3. 'Formulation and Optimisation of Mathematical Models' by C.L.Smith, R.W.Pike and P.W.Mur
4. 'Optimization of Chemical Process' by Edgar and Himmelblau, 2nd Edition, McGraw Hill Publications.

CHE-423 Process Engineering Economics

Value of money - equivalence: Value of money, equations for economic studies, equivalence, types of interest- discrete and continuous, annuities - relation between ordinary annuity and the periodic payments, continuous cash flow and interest compounding, present worth of an annuity, perpetuities and capitalized costs, bonds and debentures, value of a bond and yield rate,

Depreciation: Types and various methods of calculating depreciations, depreciation accounting,

Cost accounting: Basic relationship in accounting, balance sheet and income statement, various ratios to study the balance sheet and income statements,

Cost estimation: Cash flow for industrial operations, factors affecting investments and production costs, estimation of capital investment, cost indices, cost factors in capital investment, methods of estimating capital investment, estimation of total product cost- manufacturing costs and general expenses,

Profitability: Alternate investments and replacements. mathematical methods for profitability evaluation, economic production charts for plants operating below 100%, above 100% and under dumping conditions, general procedure for determining optimum conditions, break even chart for production schedule and its significance for optimum analysis,

Employability

Economic balance in fluid flow, heat transfer and mass transfer operations; optimum economic pipe diameter in fluid dynamics, optimum flow rate of cooling water in condenser in heat transfer and optimum reflux ratio in distillation operation,

Economic balance in cyclic operations and semi continuous cyclic operations, economic balance in yield and recovery, economic balance in chemical reactors, batch and flow reactors.

Employability

Text books:

1. `Plant Design and Economics for Engineers' by Max S. Peters and K.D.Timmerhans, McGraw Hill Book Company,

2. `Process Engineering Economics' by Herbest E. Schweyer, McGraw Hill Book Company.

CHE-424 Chemical Process Equipment Design Laboratory

(Open book practical examination)

The following equipment are to be designed in detail:

Skill development

1. Sensible heat exchangers (1-2 or 2-4),
2. Condenser and reboiler,
3. Multiple effect evaporator,
4. Fractionating column-Plate and packed columns,
5. Packed bed absorber,
6. Continuous tubular reactor (homogeneous and heterogeneous)

CHE-425 Project Work

The project work should consist of a comprehensive design of a chemical plant in the form of a report with the following chapters.

Skill development/Employability

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

CIV124 CIVIL ENGINEERING MATERIALS

(For B.Tech. I Year II Semester Civil Engineering)

L	T	P	C	Sessional marks	End Exam marks
3	1	0	3	40	60

Course Objectives:

1) To know the characteristics of good building materials such as bricks, stone, timber, metals, plastics, geosynthetics, paints, varnishes, distempers etc.
2) To understand the procedure to conduct required tests to determine the suitability of the material for the given application
3) To study the engineering materials available in the region of Visakhapatnam, Andhra Pradesh and India

Course Outcomes:

At the end of the course, the student will have

a) the ability to identify good building materials such as bricks, stone, timber, metals, plastics, geosynthetics, paints, varnishes, distempers etc. based on their characteristics
b) the ability to conduct required tests to determine the suitability of the material for the given application
c) the Knowledge of the engineering materials available in the region of Visakhapatnam, Andhra Pradesh and India

Unit I

Introduction: Classification of Building materials, uses

Bricks & Other Clay Products:

Skill Development

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; Special bricks: Fire bricks, Heavy duty bricks, perforated bricks, Facing bricks, Lining bricks, Paving bricks, Hollow bricks, Sewer bricks, Soling bricks; Fly ash bricks; Special brick shapes.

Other Clay Products: Tiles- Characteristics of good tiles; Types of common tiles; Classification and properties of Flooring tiles (IS:1478) and Roofing tiles (IS:654); Terracing tiles (IS:2690); Mangalore tiles, Country tiles, Hollow clay tiles. Terra-cotta; Earthenware, stoneware, porcelain; Glazing; Refractories

Unit II

Skill Development

Stones: Quarrying & dressing of stones; Characteristics of good building stones, Common building stones, Uses in Civil Engineering

Timber: Characteristics of good timber; defects in timber, Decay of timber, Seasoning and preservation, properties, tests; uses of timber; Commercial forms of timber products in Civil Engineering; Indian timber trees.

Unit III

Metals: Ferrous metals: Properties & uses of different types of iron; non-ferrous metals: Aluminium & Lead, properties, ~~uses in civil engineering~~

Skill Development

Glass: Classification & Commercial forms of glasses, uses in civil engineering

Miscellaneous Materials: Asbestos- Properties; uses; Gypsum- Gypsum boards; Gypsum plaster; Rubber – Properties & uses

Skill Development

Unit IV

Plastics: Types of plastics, properties, uses in civil engineering, Fibre glass Reinforced plastics, Properties & Applications.

Geosynthetics: Introduction, Functions and their Applications-tests on geo-textiles, geogrids; geo-membranes and geo-composites;

Skill Development

Unit V

Paints, Varnishes and Distempers : Paints: Characteristics of good paint; PVCN; Ingredients of oil-borne paint; Types of paints; Defects in painting; Varnishes: Characteristics of good varnish; Ingredients; Types; process of varnishing; Distempers: Properties & ingredients; Process of distempering; Wall Paper; White wash; Colour wash.

Skill Development

Case study on Engineering materials commonly used in Visakhapatnam, Andhra Pradesh and India

Text Books

1. Rangwala, Engineering Materials, 41st Edition : 2014, Charotar Publishing House Pvt. 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. P. C. Varghese (2005), Buliding Materials, Prentice Hall
4. M. Gambhir, Neha Jamwal (2011), Building Materials: Products, Properties and Systems, Tata McGraw Hill Publishers.
5. R.C. Smith, Materials of construction, McGraw-Hill Company, New York.
6. Relevant Indian Standards

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.

Skill Development

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.

Skill Development

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

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

Tsunamis: Meaning of Tsunami, causes & Effects of Tsunami, warning and mitigation.

Skill Development

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.

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

Skill Development

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.

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. 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 bearings, Calculation of bearing for

Employability

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 in leveling - 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

Skill Development

Introduction to theories of failure: (i) Principal Stress theory, (ii) Principal Strain theory, (iii) Maximum Shear Stress theory and (iv) Maximum strain energy theory.

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 shafts.
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.

(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.

Employability

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.

Employability

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.

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 angle – 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.

Employability

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

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

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

14 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

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.

Employability

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.

Employability

(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.

Employability

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

Skill Development

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
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.

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.

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 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.

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

Survey and Highway Engineering

Skill Development

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

Irrigation and Water supply

Skill Development

Definition and classification of irrigation – Irrigation structures – dams, weirs, cross drainage works, canal drops-Quality of water-Treatment methods

UNIT – V 12 Periods

Geotechnical Engineering

Skill Development

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.

UNIT – IV 12Periods

Employability

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

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 33rd 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.

Employability

UNIT – III 16 Periods

Slabs: Design of one way slabs – Two way slabs –Continuous slabs using IS coefficients.

Employability

UNIT – IV 12 Periods

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.

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.

UNIT – II 12 Periods

Skill Development

Analysis of statically indeterminate frames (single storey), single bay portal frames only) using (i) Slope-deflection method (ii) Moment distribution method.

UNIT – III 12 Periods

Skill Development

Analysis of statically indeterminate frames (portal frames with single storey and single bay) using (i) Kani's method Skill Development ethod.

Analysis of structures for lateral load using portal method and cantilever method. (Only for Internal Assesment)

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**
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.

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.

Employability

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.

Employability

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

Employability

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.

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.

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.

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 soils-field compaction-compaction equipment based on soils, relative compaction, field tests for compaction control.

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.

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 Co[illegible]hod
   Employability
9. Determination of in-situ density by sand replacement method
10. Determination of in-situ density by core cutter method.

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

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 – Employability of different durations, applications of unit hydrograph, S-hydrograph.

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

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

Impact Assessment Methodologies: Selection of methodology, impact assessment methodologies, procedure for reviewing environment impact statement.

Skill Development

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 – r[illegible] 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 Mitigation; Greening 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.

CE411 WATER RESOURCES ENGINEERING – I

University Examination: Duration 3 hrs. Marks 70
No of Periods per Week : 3 L+ 2 T Sessional Marks: 30

UNIT – I INTRODUCTION AND HYDROLOGICAL ASPECTS:
Water Resources in India, Hydrology in water Resources Planning – Hydrologic Planning – Precipitation – Types, Measurement of rainfall, Average depth of rainfall over an area, Mean annual rainfall, Analysis of Rainfall Data-Consistency of rainfall record – Double mass curve, Depth –Intensity, Depthh area duration curves.

Infiltration – Factors affecting and its determination, Infiltrometers.

Employability

Evaporation and Evapo – Transpiration. Pan evaporation, Consumptive use, determination of evapotranspiration – Blenney & Creeddle, Penmann and Hargreeaves methods.
Runoff – Factors affecting runoff, methods of determination of runoff, stream gauging, hydrograph analysis, base flow separation, unit hydrographs – Hydrograph of different durations, applications of unit hydrograph, S-hydrograph.

Employability

UNIT II – GROUND WATER FLOW:
Mechanics of interstitial flow, definitions, sub surface distribution of water, ground water movement, Darcy's law – permeability, intrinsic permeability well hydraulics – Steady flow into different types of aquifers and wells – Determination of hydraulic properties of aquifer, Well losses, specific capacity of well, and well efficiency, pumping tests- Recuperation test method for determination of well yield.

Methods of construction of open well-yield of an open well – methods of construction of tube wells, well shrouding and well development, spacing of tube wells, design of tube well – pumping requirements, centrifugal and bore hole type pumps – collector wells.

Employability

UNIT III – RESERVOIR PLANNING:
Types of reservoir- Investigations for reservoir planning, Selection of site for a reservoir, Zones of storage in a reservoir, Purpose of reservoir, Design studies, Reservoir regulation, Reservoir yield, Mass curve and Demand curve, Determination of reservoir capacity, yield from a reservoir of given capacity, operating schedules, Rule Curve for reservoir operation, Economics of Waterresources Projects, Apportionment of total cost of a Multi Purpose project, Benefit - Cost Ratio.

Employability

Reservoir Losses – Measures to reduce evaporation loss in reservoirs sedimentation, control of reservoir sedimentation.

Employability

UNIT IV - IRRIGATION:
Definition of irrigation, Types of irrigation systems – Direct and Indirect, Lift and Inundation irrigation Systems, Methods of irrigation – Surface and Sprinkler methods, Trickle or Drip Irrigation, Soil moisture Constants, Depth of water held by soil in different zones, Water extraction - Quality of irrigation water.

Employability

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, Size of reservoir, Assessment of irrigation water charges.

Employability

UNIT V – CANAL SYSTEMS:
Classification of irrigation canals – Canal alignment, Design of unlined canals, Regime theories – Kennedy's and Lacey's theories, Critical Tractive force method, Design problems – Balancing depth – L.S. of a channel-Dsign according to I.S : 7112, 1975. Schedule of area statistics, Cross section of irrigation channel, -Maintenance of irrigation channel.

Employability

Regulation of channel system – Canal outlets, Requirements of a good outlet – Types of outlets, Water logging-Causes and control – land drainage, canal lining – methods, design of lined canals, canal navigation – requirements, methods to make navigability feasible.

Employability

REFERENCE BOOKS :
1) Water resources engineering – B.C. Punmia.

2) Water resources engineering – S.K. Garg.
3) Water power engineering – H.K. Barrows.
4) Hand book of applied hydrology – Ven te Chow.

CE 412 TRANSPORTATION ENGINEERING – I

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 3 L+ 1 T   Sessional Marks: 30

UNIT I : Highway Engineering – I : Highway development and planning, Classification of roads, Highway alignment, Highway Geometrics – Design of Cross sectional elements, Sight distance, horizontal and vertical alignment.

Employability

UNIT II : Highway Engineering – 2 : Traffic Engineering – Traffic Characteristics, Traffic studies (Surveys), Traffic Control devices – Design of intersections. Design of pavements – Design factors, design of flexible pavements – Group Index method, CBR Methods, Design of Rigid pavements – Wester guard equations, I.R.C. recommendations for design of concrete roads.

Employability

UNIT III : Highway Engineering – 3 : Construction of roads – Earthen roads – W.B.M. roads – Bitumens roads – Cement concrete roads – Highway materials and their properties and tests. Maintenance of all types of roads – Highway drainage – Arborical culture – Street lighting.

UNIT IV : Airport Engineering : Layout of Airports – Components functions – Aircraft characteristics – Airport site selection – Airport obstructions – Runway design – Visual aids – Air traffic control.

Employability

REFERENCE BOOKS :

1) Highway Engineering by Khanna & Justo.
2) Highway Engineering by Sharma & Sharma.
3) Airport planning and Design by Khanna & Arora.

CE413 PROJECT PLANNING AND MANAGEMENT

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T   Sessional Marks: 30

UNIT I : PERT and CPM : Introduction : Origin of PERT and CPM, Planning, Scheduling and controlling Bar charts, Milestone charts, weaknesses in Barcharts, PERT and CPM networks – Comparison, Event, Activity, Rules for drawing networks, Numbering the events (Fulkerson's law : Dummy activities, Time estimate-Expected time, Earliest allowable occurrence time, Latest allowable occurrence time, slack, project duration, probability of completion, Start and Finish time estimates, Floats, Project scheduling, Critical and sub-critical path.

UNIT II : Cost analysis / updating / resource scheduling : Cost Analysis direct and indirect costs, operation time, Normal and crash points, optimising project cost, crash limit, Free float limit, Optimisation. Updating – Process of updating; when to update, Resource scheduling – resource smoothening. Resource levelling, circle notation and arrow notation.

Employability

UNIT III : Contracts : Contracts – Element of contract, offer acceptance and consideration, valid contract, Department execution of works, Master Roll Form 21. Piece work Agreement form, work order; Contract system with tenders – Definitions – Contract ,Contractor, Quotation, Earnest money, Security money, Tender, Tender notice, Tender form, Bidding procedure, Irregularities in Bidding, award, Types of contracts – Lumpsum contract; Lumpsum and schedule contract, Item rate contract, sub-contracts, joint ventures, Areitration Disputes and claim settlement.

Employability

UNIT IV : 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, Workmen compensation Act 1923, and subsequent amendments, Minimum Wages Act 1948.

Employability

REFERENCE BOOKS :

1) PERT and CPM – L. S. Srinath.
2) PERT and CPM – Punmia.
3) Estimating and Costing – B.N. Dutta.
4) Construction Management and Planning – Guna and Sen Gupta, B.

CE414 ENVIRONMENTAL ENGINEERING – II

University Examination: Duration 3 hrs. Marks :70

No of Periods per Week : 4 L+ 2 T Sessional Marks: 30

UNIT – I : 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 – types of sewers – Hydraulics of sewers and storm drains– design of sewers – materials for sewers- appurtenances in sewerage – cleaning and ventilation of sewers—safety of sewer workers .

Employability

UNIT – II: Storm sewers- design: Pumping of wastewater – Pumping stations – location – components parts– types of pumps and their suitability with regard to wastewaters. House Plumbing: plumbing systems of drainage- sanitary fittings and other accessories– single stack system- one pipe and two pipe systems – Design of building drainage.

UNIT – III: Bacteriology of sewage: Sewage characteristics – Physical, Chemical and Biological Examination– decomposition- cycles of decomposition— Sampling and analysis of wastewater – BOD-COD-Treatment of sewage - Primary treatment: Screens-grit chambers – grease traps – floatation – sedimentation – design of primary and pretreatment units..

Employability

UNIT – IV: 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. RBCs, Fluidized bed reactors, sewage disposal methods.

Employability

UNIT – V: Anaerobic Processes: Septic Tanks and Imhoff tanks-Principles and Design-sludge treatment and disposal-Fundamentals of UASB. Biosolids (Sludge): Characteristics- thickening – digestion,drying and sludge disposal,.

Employability

<u>TEXT BOOKS</u>:

1.Wastewater Engineering Treatment and Reuse by Metcalf & Eddy, Tata McGraw-Hill edition.
2. Environmental Engineering by Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. McGraw-Hill international edition
3. Environmental Engineering –II : Sewage disposal and Air Pollution Engineering, by Garg, S.K. Khanna Publishers
4. Sewage treatment and disposal by Dr. P.N. Modi.
5. Water supply and Waste Water Engineering by Dr. B.S.N. Raju

CE415 COMPUTER APPLICATIONS IN CIVIL ENGINEERING (C A C E)

University Examination: Duration 3 hrs. Marks 50

No of Periods per Week : 3 L+ 3P Sessional Marks: 50

GENERAL : Data Base management in Civil Engineering Applications. Creation of Data Tables and Retrieval of Data using Structured Query Language.

UNIT I: Determination of Bending Moment Diagram, Deflections for different loading conditions for a Simply Supported Beam and Cantiliver Beam. Determination of fixed end moments for different loading conditions of a fixed beam. Calculation of Influence line diagrams at any section of a Simply Supported Beam.

Employability

UNIT II : Estimation of Run off for a Catchment. Estimation of Friction factor for Laminar and Turbulent flows, Minor losses in pipe flow. Conversion of Angles from WCB to RB. Classification of Soils. Determination of coefficient of permeability, Degree of Consolidation and Shear Strength.

Employability

UNIT III : Application of problems in Hydraulics such as Hardy cross method in the Analysis of pipe network, Computation of water surface profiles in open channel flows. Estimation of Settlement of foundations in Cohesive Soil, Stability Analysis of Slopes. Estimation Earth Pressures in Cohesive and Cohesionless soils. Application of problems in Environmental engg., Transportation Engg. Design of Slabs using I.S. Code method. Analysis and Design of Beams by using Limit state method. Design of columns subjected to axial load and Uni-axial Moment. Design of Isolated Footing. Design of rolled steel columns, built up columns, Beams and built up Beams.

Employability

UNIT IV : Basic AUTO CAD Commands, Introduction to AUTO LISP Programming. Analysis and Design of R.C. Building Frames by using Staad - III, Analysis and Design of Grid Floors by using Staad – III. Preparation of Contour Maps and Alignment fixing of Roads by using AUTO CIVIL. Quantity estimation of Civil Engineering Structures and Construction Management.

TEXT BOOKS :

1) Computer aided design, software and analytical tools by C.S. Krishnamoorthy & S. Rajesh.
2) Computer applications in Civil Engineering by S.K. Parikh.
3) Computer aided design in Reinforced concrete by V.L. Shah.

CE 416 A INDUSTRIAL STRUCTURES

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T — Sessional Marks: 30

UNIT – I : Connectios : Design of Frame, seated moment resisting connections(both welded and riveted).

UNIT – II : Analysis of Pitched (Gable) Portal frames, Assumptions, Bending Moment and Shear Force diagrams. Design of portal frame (dead, live and wind loads).

UNIT – III : Analysis and design of gantry ginders, Steel Bracket design.

Skill Development

UNIT – IV : Towers, Principles of Analysis and Design of Latice towers, Transmission towers. Design of lathic towers and transmission towers(only sessional work).

UNIT – V: Analysis of Mill Bends

Skill Development

TEXT BOOKS :

1. Design of Steel Structures by M.Raghupati.
2. Design of Steel Structures by Arya and Azmani.
3. Design of Steel Structures by P. Dayaratnam.
4. Design of Steel Structures by Kazmi and Zindal.

CE416 B MULTISTOREYED STRUCTURES

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T — Sessional Marks: 30

UNIT – I : Analysis of Portal Frames by Moment Distribution Methods with and without sway Analysis of continuous beams and one bay one storey Frames by Kani's method with and without sway.

UNIT – II : Introduction to Matrix methods : Analysis of continuous beams and one bay one storey portal frames by stiffness method.

Skill Development

UNIT – III : Analysis of one bay one storey portal frames and continuous beams by Flexibility matrix methods.

Skill Development

UNIT – IV : Analysis of Multistoreyed frames by substitute frame method.

Skill Development

UNIT – V : Analysis of Multistoreyed frames for wind loads by portal, cantilever and Girder Factor methods.

(For Saessional Work only)
Introduction to shear walls, Different types – Behaviour of cantilever walls with rectangular cross section – Flanged shear walls.

1. Analysis of Inderminate structures – C.K Wang 2. Matrix Analysis of framed Structures-W Weaver& Gere.

CE416 C ELEMENTS OF SOLID WASTE MANAGEMENT

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T Sessional Marks: 30

UNIT 1 : 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 2 : SOLID WASTE MANAGEMENT: Definition- Reduction, reuse, recycling and recovery principles of waste management- Functional elements of Solid Waste management- Waste generation and handling at source-Collection of solid wastes- Collection methods and services- guidelines for collection route layout.

Employability

UNIT 3 : TRANSFER AND TRANSPORT OF WASTES: Transfer station-Processing and segregation of the soilid waste- various methods of material segregation.

Employability

UNIT 4 : PROCESSING AND TRANSFORMATION OF SOLID WASTES: Composting: definition-methods of composting-advantages of composting- Incineration: definition- methods of incineration-advantages and disadvantages of incineration.

UNIT 5 : DISPOSAL OF SOLID WASTE: Volume reduction, Open dumping, land filling techniques. Landfills: classification-Design and Operation of landfills, Land Farming, Deep well injection.

Employability

Reference Books : Integrated Solid Waste Management by T
Environmental Engineering by Howard S.Peavy, Donald R.Rowe and George Tchobanognous

CE416 D SOIL DYNAMICS AND MACHINE FOUNDATIONS

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T Sessional Marks: 30

UNIT – I : Types of machine foundations – General requirements, Design criteria for machine foundations, Permissible amplitudes and bearing pressures.
Resonance and its effect – free and forced Vibrations with and without damping – Constant force and rotating mass type excitation – Magnification factor – Phase difference between forces and displacement for steady state vibrations – Logarithmic decrement.

Employability

UNIT – II : Natural frequency of foundation – soil system – Barkan's and I.S. methods of determining natural frequency. Tachehotarioff's reduced natural frequency.
Elastic properties of soil for dynamical purpose and their experimental determination of shear modulus from wave theory.

EMPLOYABILITY

UNIT – III : Apparent soil mass – bulb of pressure concept – Pauw's analogy of foundation – soil system (charts to be supplied for solving problems).
Theory of elastic half – space lamb and the dynamic Boussinesq problem – Reisner's solution and its limitations – Quinlan and Sung's modifications Hsiegh's equations for vertical vibration.

UNIT – IV : Principles of design of foundations for reciprocating and impact type of machine – as per I.S. codes.- Vibration isolation – types and methods of isolation – isolating materials and their properties.

Employability

REFERENCES :

1) Hand-book of machine foundations by Srinivasulu and Vaidyanathan – M/s. Tata McGraw Hill Publications.
2) I.S. Codes.
3) Soil Mechanics and Foundation Engineering by B.C. Punmia – M/s. Lakshmi publishing co.
4) Analysis and design of Foundations and Retaining Structure by Shamsher prakash, Gopal Ranjan and Swamisaran – M/s Saritha Prakashan, Meerut.
5) Vibrations of soils and Foundation by Richart Hall and Woods Prentice Hall Inc., New Jersey.

CE416 E PRINCIPLES OF WATER QUALITY MANAGEMENT

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T Sessional Marks: 30

UNIT 1 : Introduction- importance of water quality management-Pollution of surface water bodies – Rivers, Reservoirs and Lakes –The impacts on the natural water bodies -Sampling procedures for the estimation of characteristics.

UNIT 2 : Modeling the fate of pollutant in natural water: Fundamentals of process and mechanisms-Conventional Streeter-Phelps BOD-DO models, Critical deficit and time required to reach the critical deficit.

Skill Development

UNIT 3 : Fundamentals of ground water flow – variations of ground water levels, fluctuations due to Evapotranspiration, Meteorological phenomena

UNIT 4 : Groundwater pollution and management – Sources of ground water pollution and their effects – municipal, industrial, agricultural and miscellaneous, ground water basin investigations. Groundwater modeling techniques.

Skill Development

UNIT 5 : Introduction to Urban storm water quality management - Groundwater remediation – Groundwater recharging- recharging methods.

Skill Development

Reference Books:

1. Ground Water Technology by B. K. Todd.
2. An introduction to Water quality modelling. James,A.
3. Surface water quality modeling by Chopra, S.C

CE416 F PORT AND HARBOUR ENGINEERING

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T Sessional Marks: 30

Unit – I

Description and formulation of waves and tides in the ocean, Linear wave theory, wave generation, wave transformation; Shoaling, refraction, diffraction and reflection, wave prediction techniques, Long waves in irregular shaped basins or bays, harbor oscillations.

Unit – II

Growth and regulation of ports. Various components of maritime systems, including shorefront and inlan infrastructure, Docks and Repair facilities, Concepts of port and marine terminal design, cargo handling equipment and intermidal transportation networks.

Unit – III

Port and harbor layout for safe and efficient vessels navigation and cargo loading and unloading. Port buildings. Port and marine terminal layout, navigation channels and dredging, shore infrastructure and utilities, land reclamation , and environmental and economic considerations. Dredging; dredging equipment. Dredging for navigation improvement, pipelines and cables, soil replacement. Potential effects of dredging on environment, environmental factors.

Unit – III

Foundamentals of port structures design, design codes, guidelines and functional requirements. Structural, geotechnical, and materials considerations, for a variety of environmental conditions, including extreme wave and current environments, ice, and seismic loading.

Skill Development

Unit – IV

Functional desing of the various components of ports and marine terminals, including steel, concrete, timber, and stone structures. Design procedures for breakwaters, bulkheads, wharves, dolphins, piers, fender and mooring systems and revetments.

Skill Development

Unit – V

Marine and offshore construction equipment: Basic motions of swaway Barges, crane barges, Offshore derrick barges, semisubmersible barges, Jack-up construction barges, launch barges, pipe laying barges, floating concrete plant. Pile driving equipment.

Skill Development

Reference Books / Text Books

1. Port Engineering, by Per Bruun
2.Design and construction of Ports and Marine Structures, by A.D. Qinn, Mc Graw-Hill
3. PHRI (Port and Harbour Research Institute) Japan manual.
4. Handbook of Port Harbour Engineering: Geotechnical and structural aspects, by Gregory Tsinker
5. Construction of marine and offshore structures, by Ben C. Gerwick, CRC Press Tayler and Francis group.
6. Dredging: A Handbook for Engineers by R.N. Bray, A.D. Bates and J.M. Land: John Wiley & Sons, Inc.
7. Planning and Design of Ports and Maritime Terminals: 2ed, edited by Hans Agershou: Thomas Telford

CE417 TRANSPORTATION ENGINEERING LABORATORY

University Examination: Duration 3 hrs. Marks 50

No of Periods per Week : 0L+ 3P — Sessional Marks: 50

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.

Employability

3) Testing on Soils : C.B.R. test (IS 2720 – Part-XVI) – N.D.C. Penetration test (IS 2720 Part-XXXII) – Group Index.

REFERENCE BOOKS :

1) Highway material testing by Khanna & Justo.

CE418 FLUID MECHANICS LABORATORY– II

University Examination: Duration 3 hrs. Marks 50

No of Periods per Week : 0 L+ 3P — Sessional Marks: 50

1) Characteristics of a hydraulic jump. - To measure and draw Y_2/Y_1, $(E_1 – E_2)/E_1$, $Lj/(Y_2-Y_1)$ as a function of F_r, and compare with theoretical results wherever possible.
2) Canal transitions– To measure the depth of water in canal transitions (a) with a reduction of bed width and (b) With a rise in bed level.
3) Pipe friction. (a) To measure the piezometric head variation along the length of a pipe and compute Darcy- Weisbach f. (b)To plot H.G.L and T.E.L.

Employability

4) Drag characteristics of a circular cylinder with its axis normal to the direction of flow.
(a) To measure the pressure distribution on the surface of a cylinder and plot the dimensionless pressure variation around the cylinder and compute the pressure drag.

(b)To measure the velocity variation in the wake of the cylinder, velocity of approach, and compute the total drag by momentum principle.

5) Performance characteristics of a centrifugal pump. - To measure the discharge, head developed, and power input at various discharges for centrifugal pump and draw the performance characteristics.
6) Performance characteristics of a reciprocating pump.
7) Performance characteristics of a Pelton / Francis / Kaplan turbine. - To measure the discharge, head difference across the turbine, the brake load, speed of turbine for various discharges and draw the performance characteristics.
8) Impact of a jet on bodies.

Employability

CE419 INDUSTRIAL TRAINING

The students are supposed to submit a detailed report covering the following aspects related to civil engineering projects that are relavant to the industry in which they received training:

- Project Planning,
- Design,
- Scheduling,
- Specifications,
- Tender Document Preparation,
- Calling of Tenders,
- Material Procurement Methods / Pracices,
- Inventory, Stores Maintenance and Material Issue Norms,
- PERT / CPM Details,
- Project Execution,
- Check Measurement,
- Project Management,
- Quality Control,
- Safety and Risk Analysis and
- Maintenance, Repairs and Operation.

Skill Development

The report will be evaluated for 100 marks by a viva-voce committee comprising of the following members:

- Head of the Department
- Two internal Examiners
- One external examiner and
- Chairman Board of studies.

CE421 TRANSPORTATION ENGINEERING– II

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 3 L+ 1 T Sessional Marks: 30

UNIT – I : RAILWAY ENGINEERING – 1 : Historical development of railways in India – Advantages of Railways – Classification of Indian Railways – Permanent way – Components and their functions – Rail joints – Welding of Rails – Creep of Rails – Rail fixtures & Fastenings.

UNIT – II : RAILWAY ENGINEERING – 2 : Track Geometric design – Points & Crossings – Track drainage – Layout of Railway stations and yards – Signals – Interlocking – Track circuiting – Track Maintenance.

Employability

Employability

UNIT – III : DOCK & HARBOUR ENGINEERING : Layout of Port components – Functions – Classification of Ports – Site selection – Natural Phenomenon – Tides, Winds, Waves, Currents – Drift – Navigational aids.

UNIT – IV : TUNNEL ENGINEERING : Alignment of tunnels – Cross-section of tunnels – Construction methods of Tunnels – Tunnel lining – Ventilation – Drainage – Muck disposal.

Employability

REFERENCE BOOKS :

1) Railway Engineering by S.C. Saxena & S. Arora.
2) Railway Engineering by Rangwala.
3) Dock & Harbour by Birdie.
4) Tunnelling by Rangwala.

CE422 WATER RESOURCES ENGINEERING – II

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 3 L+ 2 T Sessional Marks: 30

UNIT – I Storage Works : Classification of dams, factors governing selection of types of dam, selection of site, preliminary investigation.

Gravity Dams : Forces acting on a gravity dam, stability criteria, modes of failure – elementary and practical profiles, stability analysis, principal and shear stress – construction joints, openings in dams – galleries, foundation treatment of gravity dam.

Employability

UNIT – II Earth Dams : Types, foundation for earth dams, design of 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, energy dissipation below spill way, scour protection, use of hydraulic jump as energy dissipater – design of stilling basins – USBR and IS standard basins - spillway crest gates, different types.

Employability

UNIT – III Diversion Head Works : Types, location and components, effects of construction of weirs on permeable foundation, Bligh's, Lanes and Khosla's theories, Method of independent variables, design principles of weirs and barrages, design of weirs on permeable foundations, design of vertical drop weir, canal head regulator, silt control devices.

Employability

Regulation Works : Canal falls, definition necessity and location, classification of falls, design principles of syphon well drop, notch fall, sarada fall, straight glacis fall, offtake alignment, cross regulator and distributary head regulator.

Employability

Cross Drainage Works : Types, factors affecting the suitability of each types, classification of aqueducts, design principles of different types of aqueducts.

Employability

UNIT – IV River Training Works : River Training and its objectives, classification of river training works, marginal embankment, guide banks, groynes, cutoffs, bank pitching, launching aprons, miscellaneous types of river training works.

Water Power engineering : Development of hydro power in India, assessment of available power, utilisation factor, load factor, diversity factor, storage and pondage, types of hydro power schemes, components of hydel schemes – fore bay, intake structure, trash racks, surge tanks, water hammer pressure, sub structure and super structure of power house.

Employability

REFERENCE BOOKS :

1) Water resources engineering– B.C. Punmia.
2) Water resources engineering– S.K. Garg.
3) Water power engineering – H. K. Barrows.

CE423 ELECTIVE – IV

CE423 A ADVANCED CONCRETE STRUCTURES

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T Sessional Marks: 30

UNIT – I : Yield Line Analysis : Analysis and Design of Slabs using yield line theory. Slabs supported on four edges, three edges and two opposite edges subjected to uniformly distributed load.

Employability

UNIT – II : Grid Floor : Analysis and Design of Grid Floors as per IS Code and more rigorous method.

UNIT – III : Design of Bunkers and Silos.

UNIT – IV : I.S. Code provisions for ductility of concrete structures, Serviceability requirements with regard to deflection and crack width.

UNIT – V : Flat Slabs – Different Components of a Flat Slab, Direct Design Method, Bending Moments in the interior and end Spans.

<u>TEXT BOOKS</u> :

1) Advanced Reinforced Concrete designed by N. Krishnam Raju.
2) Design of Reinforced Concrete Structures by P. Dayaratnam.
3) Reinforced Concrete Structures by Paurk and Pauly.

CE423 B PRESTRESSED CONCRETE

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T — Sessional Marks: 30

UNIT – I : Introduction, Basic concepts of prestressing, need for high strength steel and concrete, advantages of prestressed concrete.
Materials for prestressed concrete, high strength concrete and high strength steel.
Prestressing systems (1) Fressinet System (2) Gifford Udall (3) Magnel Blatan System, Tensioning devices, anchoring devices. (d) Pretensioning and Post tensioning.

UNIT – II : Prestressing losses, Elastic shortening, loss due to shrinkage, loss due to creep, loss due to friction, loss due to curvature etc. I.S. code provisions.

UNIT – III : Analysis of prestress members, assumptions, pressure, or thrust line concept of load balancing, cable profile, kern distance, stress in tendons as per IS 1343, cracking moment.

UNIT – IV : Limit state design of flexural members, stress, I.S. code provisions, design of symmetrical beams, design of prestressed concrete poles, design for shear, I.S. code provisions.

UNIT – V : (a) Transfer of prestress (Pretensioned members), Transmission length, bond stress, Transverse tensile stress, End Zone reinforcement, flexural bond stress, I.S. Code Provisions.
(b) Anchorage zone in post tensioned members, stress distribution in end block, Guyon's method of approach of analysis of end block (Not more than 2 cables).

TEXT BOOKS :

1) Prestressed Concrete by P. Dayaratnam.
2) Design of Prestressed Concrete Structures by T.Y. Lin and Ned. H. Burns.

CE423 C AIR POLLUTION CONTROL

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T — Sessional Marks: 30

UNIT – I : Air Pollution and its definition – Factors influencing air pollution – Classification of pollutants particulates – Gases-Sources of pollution – Air qualities standards – effects – Location of Industries.

UNIT – II : Meteorology – Wind roses – lapses rates – mixing depth atmospheric dispersion – plume behaviour accumulation, estimation of pollutants – Effective stack height.

UNIT – III : Air Pollution effects on human beings, animals, plants and materials. Air Pollution Episodes in India and abroad.

UNIT – IV : Ambient air quality monitoring and stack monitoring.

UNIT – V : Control of air pollution – Removal of pollutants – particulate and gaseous – Air pollution control equipments (units) such as setting chamber, cyclones, wet scrubbers/collectors, scrubbers, centrifugal scrubbers spary towers, packed beds, electrostatic precipitators, after burners-absorption – adsorption – Diffusion.

Employability

REFERENCES :

1) Air Pollution Control Technology by T. Painter.
2) Elements of Air Pollution Control by Prof. T. Shivaji Rao.
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.

CE423 D GROUND IMPROVEMENT TECHNIQUES

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T Sessional Marks: 30

UNIT – I : In-situ densification Methods in granular soils – Introduction of Vibration at the ground surface, Impact at the Ground surface, Vibration at depth, Impact at depth.
In-situ Densification methods in cohesive soils, introduction, preloading or dewatering, drainwalls, sand drains, sand wicks, geodrains/banddrains, stone and lime columns, forced vaccum preconsolidation, thermal methods.

UNIT – II : Grout injections, suspension and solution grouts, grouting equipment and methods, Applications.
Reinforced Earth: Principles, components of reinforced earth, factors governing design of reinforced earth walls.

Employability

UNIT – III : Geotextiles : Introduction, types of geotextiles; Functions and their application, tests for geotextile materials, geogrids, functions.
Mechanical stabilization: Soil aggregate mixture, properties and proportioning techniques, soft aggregate stabilization, compaction, field compaction control. Cement stabilization, Mechanism, factors affecting and properties, use of additives, design of soil cement mixtures, construction techniques.

UNIT – IV : Lime and Bituminous Stabilization : Types of admixtures, mechanism, factors affecting, design of mixtures, construction methods.

Employability

Stone columns, introduction, construction practice, design principles, vibrofloatation techniques and other techniques like dynamic replacement etc.

REFERENCE BOOKS:

1) Robert M. Koerner : Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill.
2) E. J. Yoder : Principles of pavement design, John Wiley and sons.
3) Leonards, G.A. Foundation Engineering.
4) Khanna S.K. and Justo C.E.G: Highway Engineering Nemchand Publications.
5) Sowers G.F. : Introductory Soil Mechanics and Foundations.

CE423 E COASTAL ENGINEERING

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T Sessional Marks: 30

UNIT – I : Mechanics of Wave Motion : Wave fundamentals and classification of waves, small amplitude wave theory, wave celerity, length, and period, orbital motions, pressure distribution, wave trains and wave energy, transformation of waves, higher order wave theories, stokes higher order wave theories, cnoidal wave theory, wave refraction, wave diffraction, wave reflection, wave breaking.

UNIT – II : Tides, Storm surges, Tsunamis - Wave Prediction : Wave height variability, energy spectra of waves, directional spectra of waves, wind information needed for wave prediction, estimating the wind characteristics, delineating a fetch, forecasts for lakes, bays, and estuaries, significant wave method, wave spectrum method, forecasting wind waves in shallow water, deep water relation for wave decay, hurricane waves.

Skill Development

UNIT – III : Littoral Processes : Ocean currents, long shore currents and setup due to ocean waves, sediment transport in the offshore zone, surf zone, bar-berm prediction and budget of the littoral zone.

UNIT – IV : Wave runup, over topping and transmission - Wave Forces : Wave forces on cylinders and walls.

Skill Development

REFERENCES :

1) Ippen, A.T., Estuary and coastline hydrodynamics, Mc Graw – Hill book company Inc., 1966.
2) Sorensen, R.M., Basic coastal engineering, John Wiley & Sons, 1978.
3) U.S. Army Coastal Engineering Research Center, Shore protection manual, Vols. I, II and III, 1977.

CE423 F HYDRAULIC STRUCTURES

University Examination: Duration 3 hrs. Marks 70

No of Periods per Week : 4 L+ 2 T Sessional Marks: 30

UNIT – I : Straight Gravity concrete Dams : Single-step design, multiple-step design, Internal stresses in gravity dams, stress distribution around openings, stress distribution around a circular hole in an infinite plate due to a normal stress on the plate, stress distribution around a horse shoe shaped gallery using phillips and zanger's tables, design of reinforcement around galleries in dams.
Arch Dams : Economic central angle of an arch dam, constant radius method, constant angle method, and variable radius and variable angle design of arch dams, trial load method of analysis of arch dams.

UNIT – II : Earth Dams : Seepage analysis, stability analysis of infinite slopes with and without seepage, stability analysis of finite slopes – friction circle method, method of slices, ordinary method of slices, simplified Bishop method of slices, spencer's method.
Spillways : Hydraulic design of ogee spillways, comprehensive discharge characteristics of ogee spillways, design of reinforcement in the crest region of an ogee spillway, hydraulic design of chute spillways, morning glory spillways, side channel spillways.
Stilling basins and energy dissipaters: Intake Structure:

Skill Development

UNIT – III : Water Conductor System : Selection of type of water conductors, economic analysis for determination of sizes of water conductors, analysis and design of lined pressure tunnels, water hammer analysis, analysis and design of surge tanks of various types, design of anchor blocks for penstocks, design of penstock junctions, design of scroll cases and draft tubes.

Skill Development

UNIT – IV : Gates and Valves : Vertical lift gates, tainter gates, cylindrical gates, butterfly valves, Howell – Bunger valves, needle valves, flow induced forces on vertical lift gates, flow induced vibration of vertical lift gates. Layout of Power Houses.

Skill Development

REFERENCES :

1) Creager, W.P. Justin, J.D., and Hinds J., Engineering for dams, Vol.II, Wiley Eastern Private Limited, 1945.
2) Creager W.p. and Justin J.D. Hydro electric hand book, John Wiley & Sons Inc., Newyork, 1949.
3) U.S.B.R. Design of small Dams, 1960.
4) Davis and sorensen, Handbook of applied hydraulics.
5) Lambe and Whitman, Soil Mechanics.
6) Streeter, V.L. and Wylie, G.B. Hydraulic Transients, Mc Graw Hill Book Company, 1967.
7) Hanif Chaudhry, M. Applied Hydraulic Transients, Van Nostrand Reinhold Company, 1979.

CE424 IRRIGATION STRUCTURES0 – DESIGN AND DRAWING (SESSIONAL WORK ONLY)

University Examination: Duration 0 hrs. Marks 0

No of Periods per Week : 0 L+ 4 D Sessional Marks: 50

(a) Tank surplus weir ; (b) Barrage : (c) Glacis type of canal drop : (d) Notch Fall : (e) Syphon Aqueduct (type III) (f) Cross regulator and head regulator

Skill Development

TEXT BOOKS :

1) Water resources Engineering – C. Satyanarayana Murthy.
2) Water resources Engineering – S.K. Garg.
3) Type Designs of Irrigation Structures _ R.S.N. Murthy.

CE425 PROJECT WORK

University Examination VIVA VOCE Marks: 50

No of Periods per Week : 0 L+ 6T

Skill Development

Sessional Marks: 50

OBJECT ORIENTED PROGRAMMING WITH C++ LAB

200

(Common for all branches, except for Civil & Chemical branches)

CSE 128 | **Credits :3**

Instruction : 2 Periods/Week & 3 Practicals/week | Sessional Marks :50

End Exam:3 Hrs | End Exam Marks : 50

Course Objectives :

- ➢ To introduce Object Oriented Programming (OOP) using the C++ Language.
- ➢ To provide the basic concepts and techniques which form the Object Oriented Programming paradigm.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Understand how to use the programming constructs of CPP.
2.	Use Object Oriented Programming concepts to develop object oriented programs.
3.	Apply various object oriented features to solve real world computing problemsusing C++ language.

SYLLABUS

List of the experiments to be done on the following topics

1. Overview (Transition from C)
2. OOP Concepts and Characteristics EMPLOYABILITY
3. Preprocessor , Command line arguments
4. Classes & Data Abstraction EMPLOYABILITY
5. Objects EMPLOYABILITY
6. Operator Overloading EMPLOYABILITY
7. Inheritance EMPLOYABILIT
8. Virtual Functions & Polymorphism EMPLOYABILITY
9. I/O Streams
10. Templates EMPLOYABILITY
11. File Processing
12. Exception Handling Concepts EMPLOYABILITY

EMPLOYABILITY

REFERENCE BOOKS:

1. Mahesh Bhave , Sunil patekar*Object Oriented Programming in C++* Second edition , Pearson
2. R Rajaram, *Object Oriented Programming in C++* 2nd Edition New Age International Publishers

3. Herbert Schildt*C++ the Complete Reference* III edition, TMH 1999

4. E Balaguruswamy*Object Oriented Programming with C++*3rd Edition, McGraw Hill

LIST OF SAMPLE PROGRAMS

1. Write a C++ program that uses a recursive function for solving Towers of Hanoi problem.
2. Write a C++ program to find both the largest and smallest number in a list of integers.
3. Write a C++ program that uses function templates to solve problems 1 and 2 experiments
4. Write a C++ program to implement the matrix ADT using a class. Use operator overloading for implementation
5. Write the definition for a class called **Rectangle** that has floating point data members length and width. The class has the following member functions: **void setlength(float)** to set the length data member **void setwidth(float)** to set the width data member **float perimeter()** to calculate and return the perimeter of the rectangle **float area()** to calculate and return the area of the rectangle **void show()** to display the length and width of the rectangle **intsameArea(Rectangle)** that has one parameter of type Rectangle. sameArea returns 1 if the two Rectangles have the same area, and returns 0 if they don't.

1. Write the definitions for each of the above member functions.
2. Write main function to create two rectangle objects. Set the length and width of the first rectangle to 5 and 2.5. Set the length and width of the second rectangle to 5 and 18.9. Display each rectangle and its area and perimeter.
3. Check whether the two Rectangles have the same area and print a message indicating the result. Set the length and width of the first rectangle to 15 and 6.3. Display each Rectangle and its area and perimeter again. Again, check whether the two Rectangles have the same area and print a message indicating the result

6. Create a class called MusicIns to contain three methods string(),wind() and perc(). Each of these methods should initilialize string array to contain the following

   i. Veena, guitear, sitar, sarod and mandolin under string

   ii. Flute, clarinet, saxophone, nadaswaram and piccolo under wind

   iii. Table, mridangam, bangos, drums and tambour under perc

   It should also display the contents of the arrays initialized , create a sub class call TypeIns to contain a method called get() and show(). The get() methods must display a menu as follows

- String instruments
- Wind instruments
- Percussion instruments

The show method should display the relevant details according to user choice .the base class variable must be accessible only to its derived classes.

7. Create a base class called shape. It should contain two methods getCoord(), showCoord() to accept x and y co ordinates and to display the same respectively . Create a sub class called Rect. It should contain method to display length and breadth of the rectangle called showCoord() . In main method, execute the showCoord() of Rect class by applying the dynamic method dispatch concept
8. Create a class called car. Initialize the color and body attributes to “blue” and “wagon”. there should be two constructors one is a default the creates blue wagon the other constructor should take two argcolor, body and initialize. write method toString() that returns the color and body. Create a sub class funcar. In sub class there are two constructors to invoke super class constructors resp. Write a method playCD in sub class that displays the message “Beautiful music fills the passenger compartment” execute the methods to show the messages

1. Mycar is a blue wagon
2. My father’s car is red convertible.

9. Create the ZooAnimal constructor function. The function has 4 parameters — a character string followed by three integer parameters. In the constructor function dynamically allocate the name field (20 characters), copy the character string parameter into the name field, and then assign the three integer parameters to cageNumber, weightDate, and weight respectively.
10. Write a C++ program to perform operations on complex numbers using operator overloading
11. Write a C++ program to write number 1 to 100 in a data file NOTES.TXT
12. Write a function in C++ to count and display the number of lines not starting with alphabet ‘A’ present in a text file “STORY.TXT”.
    Example:
    If the file “STORY.TXT” contains the following lines,
    The rose is red.
    A girl is playing there.
    There is a playground.
    An aeroplane is in the sky.
    Numbers are not allowed in the password.
    The function should display the output as 3

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.

DIGITAL LOGIC DESIGN

CSE 212 **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**
Skill Development
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.
Skill Development

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 lat[illegible] Skill Development andHazards.

UNIT-V: ProgrammableLogicDevices Skill Development **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.

CSE213 DISCRETEMATHEMATICALSTRUCTURES CREDITS: 4
(COMMON TO CSE& IT)

INSTRUCTION: 4 Theory &1Tutorial/ Week **SESSIONAL MARKS: 40**
FINALEXAM: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 set theory, relations, mathematical logic, mathematical reasoning and to study about the validity of the arguments.
CO - 2	Apply basic counting techniques to solve combinatorial problems.
CO - 3	Understand Recurrence Relation, Generating functions and solving problems involving recurrence equations.
CO - 4	Familiarize the different types of binary relations and related algorithms on transitive closure.
CO - 5	Familiarize with the applications of graphs, trees and algorithms on minimal spanning tress.

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

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 **(08Periods)**

Basics of Counting- Combinations and Permutations-Their Enumeration with and without repetition- Binomial coefficients-Binomial and Multinomial Theorems-The Principle of Inclusion-Exclusion.

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EMPLOYABILITY

UNIT III

RecurrenceRelations **(08Periods)**

Generating Functions of Sequences-Calculating their Coefficients-Recurrence relations-Solving recurrence relations-Method of characteristic Roots- Non-homogeneous Recurrence relations and their solutions.

EMPLOYABILITY

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UNITIV

RelationsandDigraphs **(09Periods)**

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 .

EMPLOYABILITY

UNIT V

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.

EMPLOYABILITY

Introduction to Trees and their properties – Spanning Trees – Depth First Search , Breadth First Search – Minimum Spanning Trees – Kruskal's Algorithm and Prim's Algorithm.

EMPLOYABILITY

TEXT BOOKS:

1). Joe L. Mott, Abraham Kandel& T. P. Baker, "Discrete Mathematics for computer scientists & Mathematicians" Prentice Hall of India Ltd, NewDelhi.

REFERENCE BOOKS:

1) Keneth. H. Rosen, "Discrete mathematics and its applications", Tata McGraw- Hill Publishing Company, NewDelhi
2) Richard Johnsonbaug, "Discrete mathematics" by Pearson Education, NewDelhi.

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.

EMPLOYABILITY

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.

EMPLOYABILITY

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.

EMPLOYABILITY

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.

EMPLOYABILITY

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.

EMPLOYABILITY

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,

EMPLOYABILITY

Correlation for Bivariate Distribution, Rank correlation coefficients.

EMPLO

Regression : Simple linear regression, regression lines and properties.

EMPLOYABILITY

UNIT IV

Testing of Hypothesis **(14 Periods)**

Formulation of Null Hypothesis, Critical Region, Level of Significance.

EMPLOYABILITY

Small Samples : Students t - distribution (Significance test of a sample mean, Significance test of difference between sample means),

EMPLOYABILITY

F- distribution, χ^2 - test, Goodness of fit.

EMPLOYABILIT

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

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

EMPLOYABILITY

3) Develop a C program to do the following
 a) Infix to Postfix conversion. b) Evaluation of postfix expression.

EMPLOYABILITY

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.

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.

EMPLOYABILITY

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.

EMPLOYABILITY

9) Write C programs for implementing the following sorting methods:
a) Merge sort b) Quick sort

10) Write C programs for implementing the following searching methods:
a) Linear Searchb) Binary search

EMPLOYABILITY

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

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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.

EMPLOYABILITY

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.

EMPLOYABILITY

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.

EMPLOYABILITY

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.

EMPLOYABILITY

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.

EMPLOYABILITY

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.

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.

10h

Skill development

UNIT V

Programming the 8086 µP

Instruction Set and Timing Diagrams Assembly Language Requirements, Data Definition, Loops Procedures, Modular programming, and Macros

5

Skill development

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

EMPLOYABILITY

Introduction to operating systems – review of computer organization – operating system structures – system calls – system programs – 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.

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

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.

UNIT IV

File Systems and its Implementation

EMPOLABILITY

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

EMPLOYABILITY

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

5 weeks

Skill Development

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.
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.
10. Programs to simulate free space management.
11. Programs to simulate virtual memory.
12. Program on deadlock management.
13. Programs to simulate deadlock detection.

EMPLOYABILITY

EMPLOYABILITY

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.

employability

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.

Week 10 & 11 employability

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.

Week 12 & 13 employability

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:

EMPLOYABILITY

File System :

File Concept, Access methods, Protection.

Storing Data-Disks and Files:

EMPLOYABILITY

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.

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:

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**.**

UNIT –III EMPLOYABILITY **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

Relations:

Introduction – Tuples – Relation Types – Relational Values - Relation Variables

UNIT-IV EMPLOYABILITY **10 Periods**

SQL: Overview –

UNION, INTERSECTION and EXCEPT – Nested Queries – Aggregation Operators – Null Values – Triggers and Active Databases –PL-SQL – Embedded SQL

UNIT-V **8 Periods** EMPLOYABILITY

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

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.

Skill Development

Process Management:

Introduction to Processes, process control block, process state diagram. Scheduling algorithm, Threads and multithreading.

Employability

UNIT-II: **15 Periods**

Process coordination:

Inter Process Communication, Classical IPC Problems: Dining philosopher problem, producer consumer problem, read & write problem.

Deadlocks:

Employability

Resources, Deadlocks, the Optical Algorithm, Deadlock Detection and Recovery, Deadlock Avoidance, Deadlock Prevention.

Employability

UNIT-III **15 Periods**

Memory Management:

Memory Management without Swapping or Paging, Swapping, Memory allocation and free space memory management algorithms.

Employablity

Virtual Memory Management:

Virtual Memory, Page Replacement Algorithms, Modeling Paging Algorithms, Design issues for paging systems, Segmentation.

Employability

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.

Employability

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.

Employability

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: EMPLOYABILITY

Guided transmission media, wireless transmission media.

Data Link Layer EMPLOYABILITY

Design issues, CRC codes, Elementary Data Link Layer Protocols, sliding window protocol.

UNIT-II: **12 Periods**

Multi Access Protocols: EMPLOYABILITY

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).

UNIT-V: **12 Periods**

EMPLOYABILITY

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/

OPEN ELECTIVE – I (for Non-CSE Students)

CONCEPTS OF OBJECT ORIENTED PROGRAMMING	
CSE 311(D)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3Periods	End Exam Marks : 60

Prerequisites:
Basic Knowledge of Programming Fundamentals
Knowledge of Programming Languages (such as C, C++)

Course Objectives:
- Understand Object Oriented ProgrammingConcepts
- Learn Basics of Java ProgrammingLanguage
- Apply Object Oriented Programming Concepts in Problem Solving UsingJava

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Identify the Classes for Real Time Applications
2.	Establish the Connectivity Among The Classes Using Inheritances and Interfaces
3.	Modularize the Application Using Packages
4.	Add the Test Cases By Including The Runtime Errors Using Exceptions Handling Mechanism.
5.	Develop the GUI Using Applet and AWT Frameworks

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: **12Periods**

OOP Concepts:
Data Abstraction, Encapsulation, Inheritance, Benefits of Inheritance, Polymorphism, Classes and Objects, Procedural and Object Oriented Programming Paradigms

Java Programming:
History of Java, Java Buzzwords, Data Types, Variables, Operators, Control Structures, Arrays, Simple Programs in Java

Introduction To Classes And Methods: 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.

UNIT-II: **12Periods**

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 Class Path, Importing Packages

UNIT-III: **10Periods**

Input / Output:

I/O Basics, Streams, Byte Streams and Character Streams, the Predefined Streams, Reading Console Input, Reading Characters, Reading Strings, Writing Console Output, the Print Writer Class, Reading and Writing Files, Automatically Closing a File

String Handling:

String Class, String Constructors, String Operations, String Conversion and toString(), StringBuffer.

UNIT-IV: **12Periods**

Exception Handling:

Fundamentals, Exception Types, Use of Try and Catch, Throw, Throws, Finally, Multiple Catches, Built-In Exceptions, User Defined Exceptions

Multithread Programming:

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 WithMultithreading

UNIT-V: **12Periods**

Applets:

Basics, Applet Class, Applet Architecture, Applet Skeleton, the HTML Applet Tag, a Simple Banner Applet, Difference between Application Program and Applet Program

Event Handling: The Delegation Event Model, Event Classes, Event Listener Interfaces, Handling Mouse and Keyboard Events

Using AWT Controls:

AWT Classes, Labels, Buttons, Check Boxes, Choice, Lists, Scroll Bars, Text Field, Text Area, Layout managers.

Text Books:

1. HerbertSchildt "*JavaTheCompleteReference*", Seventh Edition, TataMcGraw Hill.

Reference Books :

1. P.J. Deitel and H.M. Deitel, *"Java forProgrammers"*, Pearson Education
2. P.RadhaKrishna, *"Object Oriented Programming through Java"*, UniversitiesPress.

Web Resources:

1. http://www.nptelvideos.com/video.php?id=1472
2. https://www.edx.org/course/javacheng-xu-she-ji-java-programming-pekingx-04830340x
3. https://www.coursera.org/courses?languages=en&query=java

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.

EMPLOYABILITY

UNIT-III: EMPLOYABILITY **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: EMPLOYABILITY **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

EMPLOYABILITY

Security:

Access Control,DiscretionaryAccess Control - Grant and Revoke on Views and Integrity Constraints, Mandatory Access Control.

UNIT-V: EMPLOYABILITY **15 Periods**

Transaction Management:

The ACID Properties,Transactions & Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control.

EMPLOYABILITY

Concurrency Control:

2PL,Serializability and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Deadlocks, Specialized Locking Techniques, Concurrency Control without Locking.

Crash Recovery: EMPLOYABILITY

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.

Employability

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

Three Dimensional Concepts and Object representations & Transformation:

Employabil

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

Employa

Three Dimensional Viewing : Viewing Pipeline- Viewing Coordinates- Projections- View Volumes- General Projection Transformations-Clipping-Hardware Implementations- Three Dimensional Viewing.

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.

EMPLOYABILIT

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.

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.

Employability

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.

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-a Employability

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:

EMPLOYABILITY

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.

Sample Applications:

EMPLOYABILITY

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

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

EMPLOYABILITY

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

EMPLYOYABILTY

EMPLOYABILITY

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.

EMPLOYABILTY

UNIT-IV : 18 Periods

Syntax Directed Translation:

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.

EMPLOYABILTY

EMPLOYABILTY

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.

EMPLOYABILITY

Brief discussion on symbol tables, Run-time storage administration.

EMPLOYABILITY

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

Course Contents:

EMPLOYABILITY

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.

EMPLOYABILITY

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,

UNIT-II **10 Periods**

Software Architecture – Role of Software Architecture, Architecture views, Component and Connector View, Architecture Styles, Discussion, Evaluating Architectures

EMPLOYABILITY

UNIT –III

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.

UNIT-IV **10 Periods**

Testing – Testing Fundamentals, Black Box Testing, White Box Testing, Testing Process, Metrics,

EMPLOYABILITY

UNIT-V

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,

EMPLOYABILITY

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

EMPLOYABILITY

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.

EMPLOYABILITY

UNIT –III: 16 Periods

Web Servers and Servlets:

EMPLOYABILITY

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.

EMPLOYABILITY

UNIT-IV : EMPLOYABILITY EMPLOYABILITY **16 Periods**

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.

EMPLOYABILITY

UNIT-V : EMPLOYABILITY **10 Periods**

Database Access:

Database Programming using JDBC, Studying Javax.sql.* package,Accessing a Database from Servlets &JSP Page , Application – Specific Database Actions.

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

EMPLOYABILITY

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.

EMPLOYABILITY

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.

EMPLOYABILITY

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.

EMPLOYABILITY

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: Dynamic Semantics.

EMPLOYABILITY

Lexical and Syntax Analysis :

Introduction, Lexical Analysis, The Parsing Problem , Recursive-Descent Parsing, Bottom- Up Parsing .

EMPLOYABILITY

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 .

Expressions and Assignment Statements:

Introduction , Arithmetic Expressions , Overloaded Operators, Type Conversions, Relational and Boolean Expressions, Short-Circuit Evaluation, Assignment Statements , Mixed-Mode Assignment .

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:

The General Semantics of Calls and Returns, Implementing "Simple" Subprograms Implementing Subprograms with Stack-Dynamic Local Variables, Nested Subprograms ,Blocks Implementing Dynamic Scoping .

EMPLOYABILITY

UNIT- V: 10 Periods

Exception Handling and Event Handling :

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.

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.

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

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

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

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

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

CSE 4.1.1 Object Oriented Software Engineering Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30 Univ.-Exam : 3 Hours Univ-Exam-Marks:70

1. Software Engineering:
Software related problems, software engineering, concepts, development activities

EMPLOYABILITY

2. Modeling: Modeling with UML
3. Project Communications:
Project communication, modes, mechanisms and activities
4. Requirements:
Requirements elicitation, concepts, activities & managing requirements elicitation
5. Analysis:
Analysis overview, concepts, activities and managing analysis
6. System Design:
Design overview, concepts, activities and managing system design
7. Object Design:
Object design overview, concepts, activities and managing object design
8. Rationale Management:
Rationale overview, concepts, activities and managing rationale

EMPLOYABILITY

9. Testing;
Testing overview, concepts, activities and managing testing
10. Software Configuration Management:
Configuration Management overview, concepts, activities and managing configuration management
11. Project Management:
Project management overview, concepts, activities and managing project management models and activities.

EMPLOYABILITY

Text Book:
Object-Oriented Software Engineering: Conquering Complex and Changing Systems
Bernd Bruegge and Allen H. Dutoit

Pearson Education Asia

Reference Book:
Object-Oriented Software Engineering: Practical software development using UML and Java
Timothy C. Lethbridge and Robert Laganiere
McGraw-Hill Higher education

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CSE 4.1.2 COMPUTER NETWORKS Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30 Univ.-Exam : 3 Hours
Univ-Exam-Marks:70

EMPLOYABILITY

Switched Networks, Circuit-Switching Networks, Circuit Switching Concepts, Soft switch Architecture, Packet Switching Principles, X.25, Frame Relay
Asynchronous Transfer Mode: Protocol Architecture, ATM Logical Connections, ATM Cells, ATM Service Categories, Routing in Switched Networks

EMPLOYABILITY

Congestion Control in Switched Data Networks: Effects of Congestion, Congestion Control, Traffic management, Congestion Control in Packet Switched networks
Principles of Cellular Networks
Local Area Network Overview: Background, Topologies and transmission media, LAN Protocol Architecture, Bridges, Layer 2 and Layer 3 Switches

EMPLOYABILITY

High Speed LANs: The Emergence of High Speed LANs, Ethernet
Wireless LANs: Overview, Wireless LAN Technology, IEEE802.11 Architecture and Services. **Internet Protocols**: Basic protocol Functions, Principles of Internetworking, Connectionless Internetworking, Internet Protocol
Internet Operation: Multicasting, Routing Protocols: Autonomous Systems & Approaches to Routing **Transport protocols**: Connection oriented Transport Protocol Mechanisms: Reliable Sequencing Network Service, TCP: TCP Services, TCP Header Format, TCP Mechanisms, UDP

EMPLOYABILI

Distributed Applications: Electronic Mail: SMTP, HTTP Overview, Network Management Systems, SNMPv1

Text Book: Data and Computer Communications, William Stallings 7th Edition, Pearson Education, 2004
Reference Books:

1. Data Communications and Networking, Behrouz A. Forouzan, 3rd Edition, TMH, 2004
2. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose and Keith W. Ross , 2nd Edition, Pearson Education, 2002
3. Computer Networks, Andrew S. Tanenbaum, 4th Edition, Pearson Education, 2003

EMPLOYABILITY

4 An Engineering Approach to Computer Networking, S. Keshav, Pearson Education, 1997 5 Computer Networks and Internets with Internet Applications, Ddouglas e. Comer, 4th Edition, Pearson Education, 2003

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CSE 4.1.3 ARTIFICIAL INTELLIGENCE Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30 Univ.-Exam : 3 Hours
Univ-Exam-Marks:70

Introduction to Artificial Intelligence, Artificial Intelligence Technique, Representation of a problem as State space search, production systems, Problem characteristics, Production System characteristics

Skill Development

Heuristic Search Technologies
Generate & Test Hill Climbing, Best First search, Problem reduction, Constraint satisfaction, Means Endo Analysis

Employability

Predicate Logic
Proof with Backward Chaining, Resolution, question answering.

Employability

Skill Development

Representing Knowledge Using Rules:
Procedural Vs Declarative knowledge, Logic Programming, Forward Vs Backward Reasoning, Matching, Control Knowledge

Symbolic Reasoning with uncertainty
Non-monotonic Reasoning, Dependency – Directed Backtracking TMS.
Statistical Reasoning with Bayes Theorem, certainty Factors & Rule Based System, DS- Theory.

Weak & Strong Slot Filler Structures
Semantic nets, Frames, Conceptual dependencies, Scripts

Employability

Planning
Block world, Components of a Planning System, Goal State Planning, Non Linear Planning, Hierarchical Planning.

Employability

Natural Language Processing
Syntactic Analysis, Semantic Analysis, Discuses and Pragmatic Processing.

Employability

Expert Systems
Representing and Using Domain Knowledge, Expert Systems Shells, Explanation

Text Books:
1. Artificial Intelligence, Rich E & Knight K – Tata Mcgrahill (1991)
2. Introduction to Artificial Intelligence & Expert Systems, Paterson. PHI

CSE 4.1.4 MANAGEMENT PRINCIPLES Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30 Univ.-Exam : 3 Hours
Univ-Exam-Marks:**70**

1. Nature and functions of management:
   Importance of management – definition of management – management process – Roles of manager – management _ a science or art – management _ a profession.
2. Planning:
   Nature of planning – Importance of planning – Types of planning – Steps on planning.
3. Decision – Making:
   Meaning of decision – Types of decisions.

   Entrepreneurship
4. Organization :
   Span of management – principles of organizing – departmentalization.
5. Authority Delegation and Decentralization :
   Source of formal authority – difference between authority and power – line and staff authority – delegation of authority – decentralization of authority.
6. Coordination:
   Need for coordination – Types of coordination – Techniques of coordination.

   Entrepreneurship
7. Direction:
   Requirements of effective direction – Motivation.
8. Importance of communication – Purposes of communication - Formal communication - Informal communication – Barriers to communication – Principles of effective Communication.
9. Leadership:
   Difference between a leader and a manager – Characteristics of leadership – Functions of a leader – Approaches to leadership – Effective leadership – Leadership style in Indian organizations.

   Entrepreneurship
10. Managerial control :
    Steps in a control process – Need for control – Types of control methods – Essentials of Effective control systems.

    Entrepreneurship
11. Social Responsibilities of Business :

Entrepreneurship

Meaning of social responsibility – social responsibilities of business towards different groups. **Text Book:**

Entrepreneurship

Principles of Management , PC Tripathi, PN Reddy, Second Edition, Tata McGraw-Hill.

CSE 4.1.5 ELECTIVE-III EMBEDDED SYSTEMS Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30 Univ.-Exam : 3 Hours
Univ-Exam-Marks:70

Employability

Introduction to embedded systems hardware needs; typical and advanced, timing diagrams, memories (RAM, ROM, EPROM). Tristate devices, Buses, DMA, UART and PLD's. Built-ins on the microprocessor.

Interrupts basics, ISR;Context saving, shared data problem. Atomic and critical section, Interrupt latency. 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.

Employability

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 realtime and soft real time system principles, Task division, need of interrupt routines, shared data.

Employability

Embedded Software development tools. Host and target systems, cross compilers, linkers, locators for embedded systems. Getting embedded software in to the target system.

Employability

Debugging techniques. Testing on host machine, Instruction set emulators, logic analysers. In-circuit emulators and monitors.

Text Books:

Employability

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

Reference Books:

1. Frank Vahid/ Tony Givargis, Embedded Systems Design – A Unified Hardware/Software Introduction, John Wiley & Sons, Inc., 2002
2. Raj Kamal, Embedded Systems, Architecture, Programming and Design, TMH, 2003

CSE 4.1.5 ELECTIVE-III NEUTRAL NETWORKS & FUZZY LOGIC Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30 Univ.-Exam : 3 Hours
Univ-Exam-Marks:70

1. Neural Networks and Fuzzy Systems
   Neural and Fuzzy Machine Intelligence, Fuzziness as Multivalence, The Dynamical-Systems Approach to Machine Intelligence, Intelligent Behavior as Adaptive Model- Free Estimation.

2. Neural Dynamics I: Activations and Signals
   Neurons as Functions, Signal Monotonicity, Biological Activations and Signals, Neuron Fields,Neuronal Dynamical Systems, Common Signal Functions, Pulse-Coded Signal Functions.

Employability

3. Neuronal Dynamics II: Activation Models

Neuronal Dynamical Systems, Additive Neuronal Dynamics, Additive Neuronal Feedback, Additive Bivalent Models, BAM Connection Matrices, Additive Dynamic and the Noise-Saturation Dilemma, General Neuronal Activations: Cohen-Grossberg and Multiplicative Models.

Employability

4. Synaptic Dynamics I: Unsupervised Learning

Learning as Encoding, Change, and Quantization, Four Unsupervised Learning Laws, Probability Spaces and Random Processes, Stochastic Unsupervised Learning and Stochastic Equilibrium, Signal Hebbian Learning, Competitive Learning, Differential Hebbian Learning, Differential Competitive Leering.

5. Synaptic Dynamics II: Supervised Learning

Supervised Function Estimation, Supervised Learning as Operant Conditioning, Supervised Learning as Stochastic Pattern Learning with known Class Memberships, Supervised Learning as stochastic Approximation, The Back propagation Algorithm.

ility

6. Fuzziness Versus Probability

Fuzzy Sets and Systems, Fuzziness in a Probabilistic World, Randomness vs. Ambiguity: Whether vs. How much, The Universe as a Fuzzy Set, The Geometry of Fuzzy Set, The Geometry of Fuzzy Sets: Sets as Points. The Fuzzy Entropy Theorem, The Subsethood theorem. The Entropy-Subsethood Theorem.

yability

7. Fuzzy Associative Memories

Fuzzy Systems as Between-Cube Mappings, Fuzzy and Neural Function Estimators, Fuzzy Hebb FAMs, Adaptive FAMs: Product-Space Clustering in FAM Cells.

Employability

TEXT BOOK:

Neural Networks & Fuzzy Systems , Bark Kosko, PHI Published in 1994

REFERNCE BOOKS:

1. Fundamentals of Artificial Neural Networks, Mohamad H Hassoum. PHI
2. Neural network Design, Hagan, Demuth and Beale, Vikas Publishing House
3. Fuzzy Set Theory & its Application, .J. Zimmerman Allied Published Ltd.

CSE 4.1.5 ELECTIVE-III RANDOM PROCESSES IN ENGINEERING Credits:4

Instruction: 3 Periods & 1 Tut./week Sessional Marks: 30

Univ.-Exam : 3 Hours Univ-Exam-Marks:70

1.STOCHASTIC PROCESSES:- Notion of Stochastic Process, Classification of Stochastic Process according to Time and State Space; Discrete time Morkovchains, n th step transition probabilities, stationery distribution of Morkovchains, Poisson process, Properties of Poisson; Birth and Death Process, Time dependent Birth and Death process, Renewal theory, Applications of elementary renewal theorem and key renewal theorem.

EMPLOYABILITY

2. Stationary and Non Stationary processes:- AR Process; NA Process ; ARMA Process, ARIMA Process, Box and Jinkins Models, Correlogram analysis, Periodogram analysis, Spectrum of a Process.

3.QUEUEING THEORY:- Non Morkovchian queues, Phase type Technique, Embedded Markovchains Technique, GI/G/I Queues model, Polzak. Kintchins formula, queues with bulk arrivals queues with bulk services.

4. PRIORITY QUEUING MODELS:- Queues in Series, Queues in Parallel, Scheduling algorithms, Throughput analysis and waiting time distributions, Applications of Queuing theory in Communication Networks.

EMPLOYABILITY

5.RELIABILITY ANALYSIS:- Concepts of Reliability, Failure Time distributions, Hazard rate functions, Reliability of a component, Bath- tub curve, System reliability, Series systems, parallel systems, Stand by redundancy, Availability , Maintainability, Fault tree constructions, Fault analysis.

OPERATIONS RESEARCH	
CSE 416	**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)**

LINEAR MODEL
Introduction to Operations Research – Linear Programming - Mathematical Formulation – Graphical method – Simplex method – Two – Phase Simplex method ,Big-M method-Duality Simplex method.

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)**

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
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, 10^{th} 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.

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CSE 4.1.7 Graphics & Multimedia Laboratory Credits:2

Lab: 3 Periods/week Sessional Marks: 50 Univ. Exam : 3 Hours
Univ-Exam-Marks:50

Graphics: using any graphic package.

1. Drawing various types of lines and curves.
2. Creating various types text and fonts.
3. Creating two dimensional objects using the lines and curves
4. Animating the two dimensional pictures using transformations.
5. Coloring the pictures and Zooming.
6. Creating an object and applying animation of key framing.
7. Creating three dimensional objects using wire frame modeling.
8. Rotation, scaling and translating the 3 D objects.
9. Coloring the 3 D objects.
10. Shading the 3 D objects
11. Rendering the objects
12. Creating smooth surfaces.
13. Creating rugged surfaces based on fractal geometry.

Multimedia:

1 Preproduction & Presentation Graphics: Create a 7-10 slide presentation in your favorite presentation graphics application. (Power point is suggested; Corel Presentations 9 is free and is acceptable.)
2. Typefaces and Graphics: Create 1 vector and 1 bitmap graphic; they must be *your original work* created in any of the acceptable tools.
3. Desktop Publishing: Create a 2-page desktop-published "newsletter," possibly using your "What is Multimedia?" text. Include graphics.
4. Production Planning and Design: Create a proposal of project. Include summary, flowchart, element and resource lists.
5. User Interface Design & Graphics II: Create a user interface for your final project. Include 2 backgrounds and 1 button set. Aim for a cohesive look.
6. Multimedia Sound: Create 2 soundtracks and 2 EFX sounds for a previous project.
7. Digital Video: Use video capture to digitize your video shoot ro another video source to create short production (15-45 seconds)
8. Create three basic Web pages using Dreamweaver / flash or other authoring package or write bare HTML if you are able; pages must be linked and must include at least one graphic per page.

Books:

1) Prabhat K. Andleigh & Kiran Thakrar, " Mulitmedia Systems Design", Prentice Hall of India, New Delhi.
2) Calleen Coorough, "Multimedia and the Web Creating digital Excitement", Vikas Publishing House, New Delhi.
3) James E. Shuman, " Multimedia in Action", Vikas Publishing House, New Delhi.

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CSE 4.1.8 OBJECT ORIENTED SOFTWARE credits:2 ENGINEERING LAB

Lab: 3 Periods/week Sessional Marks: 50 Univ.-Exam : 3 Hours
Univ-Exam-Marks:50

Computing Platform:

Each student group chooses its own platform, subject to approval by the instructor

Course Objectives:

1. They can design and implement complex software solutions using state of the art software engineering techniques.
2. The have working knowledge of UML, source control, and project management.
3. They have deep knowledge of the technologies they used for implementing their project.
4. They know how to test and document software.
5. They are capable of working as part of a software team and develop significant projects under a tight deadline.
6. They are able to present their work in a professional manner.

Topics to beCovered:

1. Software Engineering Process.
2. Unified Modeling Language (UML).
3. Data Structures and Specification.
4. Object-oriented design.
5. Debugging.

EMPLOYABILITY

EMPLOYABILITY

Syllabus Flexibility:

High. The students are free to chose a project based on the instructor's approval.

Assessment Methods:

1. Group meetings with faculty: initial proposal, code review, tracer-bullet implementation demo, final demo.
2. Design documents. Write-up.
3. Code documentation.
4. Presentations.

the students give their final presentations and demos.

Also, each project team meets individually with the instructor at least four times during the semester. The agenda for each of the four meeting is as follows:

1. Team presents project idea and has it approved by instructor. (first month)

2. design/code review. Instructor goes over design/code with the team to point out problems and formalize requirements. Instructor determines requirements for tracer-bullet implementation. (second month) 3. Tracer-bullet implementation demo. Team shows that it has achieved full vertical integration functionality. Instructor notices missed requirements and reminds students of requirements for final project.(beginning of third month).

Final meeting. Verify requirements, design, documentation, testing, write-up, division of labor, etc. (last month).

Sessional Marks Allotment: Monthly Meeting
Participation: 10% Monthly Progress Reports: 15%
Design/code Document: 15% Presentation: 10%
Prototype Demonstration: 10% Final Project
Demonstration: 30% Final Project Report: 10%

General Software Engineering Tips:

Be careful when making major modifications and keep backups! A good motto: There is no such thing as a safe software change.

One of the biggest mistakes that even professional software teams make is modifying code at the last minute. Either resist the urge to make last minute changes, or keep them isolated and well-marked so that they can be backed out easily if necessary.
Test, test, test!!! You must test your system thoroughly after making any change, no matter how small. Else you will not know if a bug was introduced! You will get no sympathy if you break your system at the last minute.

Regression Testing:
A good habit to get into: frequently run your program on an extensive test set.

Once you have a prototype, create a set of examples that your program handles correctly. Generate files of the input and the correct output as a *test set*.

When you make significant changes, run your program on the test set. If the output is different, then you will know that you've introduced a bug. (Or if the output is improved, you should update the test set.)

Put together an extensive regression set! If it alerts you to one major bug (and it always does), then it is time well spent.

After verifying that a new change is "safe", save a version of your entire system! Never, EVER make changes to the saved version – it is a reliable version that you can recover in an emergency.

Documentation:
Get into the habit of documenting your code quickly as you go. If you think you'll remember why you did something, you are probably wrong.

Computer scientists typically hate to do documentation. One reason is that they leave it all for the end!

Get into the habit of writing small comments as you go. A few comments, explaining what's happening and why, can make a world of difference.

When you make a change, mark it with your initials, the date, a brief explanation, and an example. This will help enormously if the change needs to be removed or modified, and will prevent thrashing.

Working as a Team:
Be honest and realistic with your teammates when setting goals. If you fail to meet a promised deadline, it affects the whole team, not just you.

Communication is crucial! Don't make major decisions by yourself, and let people know when you are behind or ahead of schedule.

Try to exploit each other's strengths.

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CSE 4.1.9 INDUSTRIAL TRAINING & SEMINAR credits:2 Univ-Exam :

Employability

Internal Internal-Marks:100

The industrial training will be for three weeks during the summer after third year second semester and assessment will be done in the 4th year first semester with a seminar on the training he/she got

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ELECTIVE-IV:
[1]DATA WARE HOUSING & DATA MINING ,[2] SERVICE ORIENTED ARCHITECTURE

CSE 4.2.1 DISTRIBUTED OPERATING SYSTEMS Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30 Univ.-Exam : 3 Hours Univ-Exam-Marks:70

Introduction to Distributed Systems, What is a Distributed System?, Hard ware concepts, Software concepts, Design issues.

Communication in Distributed Systems, Lay red Protocols, ATM networks, The Client – sever model, Remote Procedure call, Group communication.

Synchronization in Distributed System, Clock Synchronization, Mutual Exclusion, Election algorithms, Atomic transactions, Deadlocks in Distributed Systems EMPLOYABILITY

Process and processors in Distributed System threads, System Models, Processors allocation, Scheduling in Distributed System, Fault tolerance, Real time Distributed System. EMPLOYABILITY

Distributed File Systems, Distributed File System Design, Distributed File System implementation, Trends in Distributed File System.

Distributed Shared Memory, Introduction, What is Shared memory?, Consistency models, Page based Distributed Shared memory, Shared – variable Distributed Shared memory, Object based Distributed Shared Memory.

TEXT BOOK**:**

Distributed Operating Systems, Andrew S. Tanenbanm

Reference Book**:**

Advanced Concepts in Operating Systems, Makes Singhal and Niranjan G.Shivaratna.

CSE 4.2.2 CRYPTOGRAPHY AND NETWORK SECURITY Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30 Univ.-Exam :
3 Hours Univ-Exam-Marks:70

INTRODUCTION: The need for security-security approaches-principles of security-Plain Text and Cipher Text substitution and Transposition Techniques-Encryption and Decryption-Symmetric and Asymmetric Cryptography Stenography-key range and key size-types of attacks

SYMMETRIC KEY CRYPTOGRAPHIC ALGORITHMS: Algorithm types and modes-overview of symmetric key cryptography-DES-IDEA-RC5-BLOWFISH-AES-Differential and Linear Cryptanalysis.

ASYMMETRIC KEY CRYPTOGRAPHIC ALGORITHMS: Overview of asymmetric key cryptography- RSA algorithm-symmetric and asymmetric key cryptography together-digital signatures-knapsack algorithm-some other algorithms.

Employability skill

PUBLIC KEY INFRASTRUCTURE: Introduction-Digital certificates- Private Key management-The PKIX model-Public Key Cryptography Standards- XML, PKI and Security

INTERNET SECURITY PROTOCOLS: Basic concepts-SSL-SHTTP-TSP-SET-SSL versus SET- 3D secure protocol-Electronic money-Email security-WAP security-security in GSM

USER AUTHENTICATION MECHANISMS: Introduction-Authentication basics-passwords- authentication tokens-certificate based authentication-biometrics authentication-kerberos-SSO approaches

Employability skill

PRACTICAL IMPLEMENTATIONS OF CRYPTOGRAPHY/SECURITY: Cryptographic solutions using Java-Cryptographic solutions using Microsoft-cryptographic toolkits-security and operating systems NETWORK SECURITY: Brief Introduction to TCP/IP- firewalls-IP security-Virtual Private Networks- case studies on cryptography and security.

Employability skill

TEXT BOOK:
Cryptography and Network security, Atul Kahate, Tata McGraw-Hill Pub company Ltd., New Delhi

REFERENCE BOOKS:

1) Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi
2) Network Security Essentials Applications and Standards, William Stallings, Pearson Education, New Delhi
3) Network Security: The Complete Reference by Roberta Bragg, Mark Phodes-Ousley, Keith Strassberg Tata Mcgraw-Hill

CSE 4.2.3 ELECTIVE-IV DATA WARE HOUSING AND DATA MINING Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30 Univ.-Exam :
3 Hours Univ-Exam-Marks:70

Employability

1. 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.
2. Data Warehouse and OLAP Technology for Data Mining
   What is a Data Warehouse? Multi-Dimensional Data Model, Data Warehouse Architecture, Data

Employability

Warehouse Implementation, Development of Data Cube Technology, Data Warehousing to Data Mining

3 Data Preprocessing

yability

Why Pre-process the Data? Data Cleaning, Data Integration and Transformation Data Reduction, Discretization and Concept Hierarchy Generation

4 Data Mining Primitives, Languages and system Architectures,Data Mining Primitives: What defines a Data Mining Task?, A Data Mining query language, Designing Graphical Use Interfaces Based on a Data Mining Query language,Architectures of Data Mining Systems

Employability

5 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

Employabilit

6 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

ployability

7 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

loyability

8 Cluster Analysis

What is Cluster Analysis? Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods

Employability

Text Book:

Data Mining Concepts and Techniques, Jiawei Han and Micheline Kamber, Morgan Kaufman Publications

Reference Books:

1. Introduction to Data Mining, Adriaan, Addison Wesley Publication
2. Data Mining Techniques, A.K.Pujari, University Press

CSE 4.2.4 DATA COMMUNICATIONS & NETWORK PROGRAMMING LAB Credits:2

Lab: 3 Periods /week Sessional Marks: 50 Univ.-Exam : 3 Hours Univ-Exam-Marks:50

FIRST CYCLE OF EXPERIMENTS

employability

1.1 PC-to-PC COMMUNICATIONS UNDER **DOS** WITH **NULL MODEM**
a) Using Serial Ports and RS-232 C Cable Connection b) Using Paralell Ports and Parallel Cable Connection

1.2 PC-to-PC COMMUNICATIONS UNDER **DOS** WITH **MODEM** and **4-LINE EXCHANGE** Using Communication Software: COMIT or XTALK

1.3 PC-to-PC COMMUNICATIONS UNDER **WIN 98's** DIRECT CABLE CONNECTION with NULL MODEM a) Using Serial Ports and RS-232 C Cable Connection b) Using Paralell Ports and Parallel Cable Connection

1.4 PC-to-PC COMMUNICATIONS UNDER **WIN 98's DIAL-UP** NETWORKING WITH **MODEM** and **4-LINE EXCHANGE**

1.5 PC-to-PC COMMUNICATIONS UNDER **WIN 98's HYPER TERMINAL** WITH **MODEM** and **4-LINE EXCHANGE**

1.6 a) LAN WITH BUS TOPOLOGY with a minimum of two systems
i) Windows Peer-to-Peer Network ii) Windows NT Client-Server Network
b) LAN WITH STAR TOPOLOGY with a minimum of two systems

1.7 a) LAN WITH BUS TOPOLOGY with a minimum of two systems using NOVELL Netware b) LAN WITH STAR TOPOLOGY with a minimum of two systems using NOVELL Netware

SECOND CYCLE OF EXPERIMENTS

2.1 INERNET CONNECTION SET-UP USING **DIAL-UP** NETWORKING

2.2 TERMINAL NETWORK WITH **UNIX/LINUX SERVER** and one or two Terminals

2.3 **TERMINAL NETWORK** WITH **UNIX/LINUX SERVER, Terminal Server,** and one or two terminals

2.4 NETWORK PROGRAMMING EXERCISE-I USING A SIMPLIFIED API
Echo software(Develop echo client and echo server programs and run the two programs on separate computers and verify that they can communicate Chat software (Develop chat client and chat server programs and test to ensure they can communicate). Build a simple file transfer service that consists of client and server

2.5 NETWORK PROGRAMMING EXERCISE -II USING THE SOCKET API

Write an echo client and server using sockets Build a web server using sockets

employability

2.6 CONCURRENT NETWORK PROGRAMMING EXERCISE –III
Build a Concurrent server(threads) – Create a server capable of handling connections from multiple clients concurrently Build a Concurrent file transfer server(processes) – Create separate processes to allow a server to handle multiple clients concurrently

2.7 NETWORK PROGRAMMING EXERCISE –IV USING PROTOCOL DESIGN
Design a reliable data transfer protocol (Devise, implement and test a protocol that provides reliable data transfer across a network that drops, delays or corrupts packets
Design stop and wait flow control protocol Design a sliding window protocol

employability

2.7.1 NETWORK PROGRAMMING EXERCISE –V WITH PROTOCOLS FROM TCP/IP SUITE Build a domain name system client program
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CSE 4.2.5 PROJECT WORK Credits:8

Project: 6 Periods /week Sessional Marks: 50 Univ Exam-Marks:50

Employability skill

GUIDELINES for preparing the report of the Project Work

FORMAT FOR PREPARATION OF PROJECT REPORT

FOR

B. TECH.(CSE)

1. ARRANGEMENT OF CONTENTS:

The sequence in which the project report material should be arranged and bound should be as follows:

1. Cover Page & Title Page
2. Bonafide Certificate
3. Abstract
4. Table of Contents
5. List of Tables
6. List of Figures

OBJECT ORIENTED PROGRAMMING WITH C++ LAB

300

(Common for all branches, except for Civil & Chemical branches)

IT-128 **Credits :3** Instruction : 2 Periods/Week & 3 Practicals/week

Sessional Marks :50 End Exam:3 Hrs, End Exam Marks : 50

Course Objectives :

- To introduce Object Oriented Programming (OOP) using the C++ Language.
- To provide the basic concepts and techniques which form the Object Oriented Programming paradigm.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Understand how to use the programming constructs of CPP.
2.	Use Object Oriented Programming concepts to develop object oriented programs.
3.	Apply various object oriented features to solve real world computing problemsusing C++ language.

SYLLABUS

List of the experiments to be done on the following topics

1. Overview (Transition from C)
2. OOP Concepts and Characteristics
3. Preprocessor , Command line arguments
4. Classes & Data Abstraction
5. Objects
6. Operator Overloading
7. Inheritance
8. Virtual Functions & Polymorphism
9. I/O Streams
10. Templates
11. File Processing
12. Exception Handling Concepts

Employability

Employability

Employability

Employability

Employability

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Employability

REFERENCE BOOKS:

1. Mahesh Bhave , Sunil patekar*Object Oriented Programming in C++* Second edition , Pearson
2. R Rajaram, *Object Oriented Programming in C++* 2nd Edition New Age International Publishers

3. Herbert Schildt*C++ the Complete Reference* III edition, TMH 1999

4. E Balaguruswamy*Object Oriented Programming with C++*3rd Edition, McGraw Hill

LIST OF SAMPLE PROGRAMS

1. Write a C++ program that uses a recursive function for solving Towers of Hanoi problem.
2. Write a C++ program to find both the largest and smallest number in a list of integers.
3. Write a C++ program that uses function templates to solve problems 1 and 2 experiments
4. Write a C++ program to implement the matrix ADT using a class. Use operator overloading for implementation
5. Write the definition for a class called **Rectangle** that has floating point data members length and width. The class has the following member functions: **void setlength(float)** to set the length data member **void setwidth(float)** to set the width data member **float perimeter()** to calculate and return the perimeter of the rectangle **float area()** to calculate and return the area of the rectangle **void show()** to display the length and width of the rectangle **intsameArea(Rectangle)** that has one parameter of type Rectangle. sameArea returns 1 if the two Rectangles have the same area, and returns 0 if they don't.

1. Write the definitions for each of the above member functions.
2. Write main function to create two rectangle objects. Set the length and width of the first rectangle to 5 and 2.5. Set the length and width of the second rectangle to 5 and 18.9. Display each rectangle and its area and perimeter.
3. Check whether the two Rectangles have the same area and print a message indicating the result. Set the length and width of the first rectangle to 15 and 6.3. Display each Rectangle and its area and perimeter again. Again, check whether the two Rectangles have the same area and print a message indicating the result

6. Create a class called MusicIns to contain three methods string(),wind() and perc(). Each of these methods should initilialize string array to contain the following

   i. Veena, guitear, sitar, sarod and mandolin under string

   ii. Flute, clarinet, saxophone, nadaswaram and piccolo under wind

   iii. Table, mridangam, bangos, drums and tambour under perc

   It should also display the contents of the arrays initialized , create a sub class call TypeIns to contain a method called get() and show(). The get() methods must display a menu as follows

- String instruments
- Wind instruments
- Percussion instruments

The show method should display the relevant details according to user choice .the base class variable must be accessible only to its derived classes.

7. Create a base class called shape. It should contain two methods getCoord(), showCoord() to accept x and y co ordinates and to display the same respectively . Create a sub class called Rect. It should contain method to display length and breadth of the rectangle called showCoord() . In main method, execute the showCoord() of Rect class by applying the dynamic method dispatch concept

8. Create a class called car. Initialize the color and body attributes to “blue” and “wagon”. there should be two constructors one is a default the creates blue wagon the other constructor should take two argcolor, body and initialize. write method toString() that returns the color and body. Create a sub class funcar. In sub class there are two constructors to invoke super class constructors resp. Write a method playCD in sub class that displays the message “Beautiful music fills the passenger compartment” execute the methods to show the messages

1. Mycar is a blue wagon
2. My father’s car is red convertible.

9. Create the ZooAnimal constructor function. The function has 4 parameters — a character string followed by three integer parameters. In the constructor function dynamically allocate the name field (20 characters), copy the character string parameter into the name field, and then assign the three integer parameters to cageNumber, weightDate, and weight respectively.

10. Write a C++ program to perform operations on complex numbers using operator overloading

11. Write a C++ program to write number 1 to 100 in a data file NOTES.TXT

12. Write a function in C++ to count and display the number of lines not starting with alphabet ‘A’ present in a text file “STORY.TXT”.
    Example:
    If the file “STORY.TXT” contains the following lines,
    The rose is red.
    A girl is playing there.
    There is a playground.
    An aeroplane is in the sky.
    Numbers are not allowed in the password.
    The function should display the output as 3

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.

employability

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).

EMPLOYABILITY

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.

EMPLOYABILITY

Unit - III: SortingandSearching **12Periods**

Sorting: General background, selection sort, bubble sort, insertion sort, shell sort, radix sort, quick sort and merge Sort.

EMPLOYABILIT

Searching: General background, linear search, binary search and Interpolation search. Introduction to Hashing, Hash Function, Hashing techniques, Collision Resolution Methods: Open Addressing, Chaining.

EMPLOYABILITY

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.

EMPLOYABILITY

Types: Heap, Binary Search Tree, AVL Tree, B-Tree of order m, introduction to Red-Black tree.

EMPLOYABILIT EMPLOYABILITY

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**

SKILL DEVELOPMENT

Sequential Circuits, Latches, Flip-Flops, Analysis of Clocked Sequential Circuits,Flip-Flop Conversions, Verilog HDL for SequentialCircuits.

RegistersandCounters **6Periods**

SKILL DEVELOPMENT

Registers, Shift Registers, Ripple Counters, Synchronous Counters, Johnson and Ring counters, Verilog HDL for Registers and Counters.

UNIT-IV: SynchronousSequentialLogic **4Periods**

SKILL DEVELOPMENT

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**

SKILL DEVELOPMENT

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.

Skill Deve

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 .

Skill D

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.

S

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

TEXTBOOK:

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,5th Edition,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-

Employability

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 EMPLOYABILITY

EMPLOYABILITY

5) Implement primitive operations of de-queue (double ended queue) using a doubly linkedlist and anarray.

EMPLOYABILITY

6) Program to perform the followingoperations:
   a) Insert an element into a binary searchtree.
   b) Delete an element from a binary searchtree. EMPLOYABILITY
   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. EMPLOYABILITY

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

EMPLOYABILITY

10)) Program to implement the following searchingmethods: EMPLOYABILITY
a) LinearSearch b) Binarysearch EMPLOYABILITY

EMPLOYABILITY

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 EMPLOYABILITY
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)

Skill Development

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.

Employability

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.

Employability

4. Data structures: Detailed overview of four major data structures of Python including list, tuple, set and dictionary, including list slicing, sorting lists, listcomprehensions.

Employability

5. Working with Files: Introduction to reading and writing files, text and binary mode. Writing parsers for simple textformats.

Employability

6. Classes and Exceptions : Introductions to classes, object creation and class inheritance and overriding methods. Introduction to exceptionhandling.

employability

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 Eulerhttps://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

EMPLOYABILITY

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

EMPLOYABILITY

EMPLOYABILITY

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

EMPLOYABILITY

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

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. Skill Develo

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. Skill

Large samples: Test of Significance of Large Samples – Single Proportion, Difference between two Proportions, Single mean and Difference of means.

Skill Dev

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.

employability

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

EMPLOYABILITY

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

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

EMPLOYABILITY

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.

EMPLOYABILITY

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

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

EMPLOYABILITY

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:

EMPLOYABILITY

1. Developing a VPN network for number of 50 users
2. TCP, UDP protocol simulation using NS2

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.
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.
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
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.

employability

employability

employability

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
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)
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.

employability

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.

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 getservbyport 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.

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.

EMPLOYABILITY

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

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.

EMPLOYABILITY

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.

EMPLOYABILITY

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:

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

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.

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.

6 Design TCP Client and Server application to transfer file.

employability

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.

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.

employability

12 Design a RPC application to add and subtract a given pair of integers.

Reference Books:

1. Advance Unix Programming Richard Stevens, Second Edition Pearson Education

employability

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.

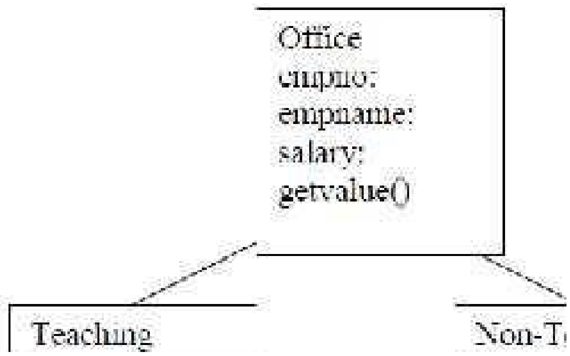
Mapping of course outcomes with program outcomes:

	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

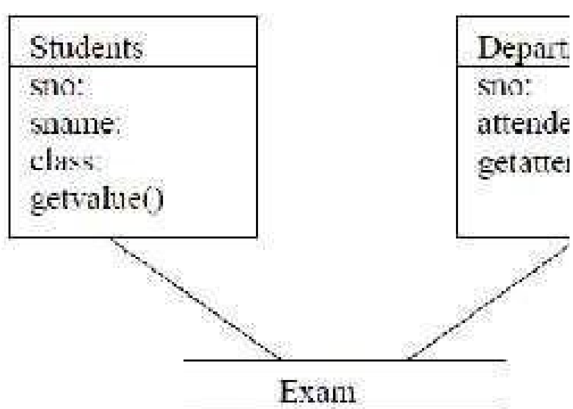
1. Write a java program to calculate gross salary & net salary taking the followingdata.
   Input : empno,empname,basic
   Process: DA=50%of basic
   HRA=25%of basic
   PF=10%of basic
   PT=Rs100/-

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 l 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.

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

Employability

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

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.

employability

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.

employability

Space and Time Tradeoffs: Sorting by Counting, Input Enhancement in string Matching – Horspool's algorithm, Hashing, B-Trees

UNIT IV: **12 Peri**

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.

employability

UNIT V: **12 Periods**

Limitations of Algorithm Power: Lower-Bound Arguments –Decision Trees –P, NP, NP hard and NP –complete problems.

employability

Coping with the Limitations of Algorithms Power: Backtracking-n Queens, Hamiltonian circuit, subset sum problem, –Branch-and-Bound-Assignment, Knapsack, Traveling Salesman problems.

employability

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.

EMPLOYABILITY

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 EMPLOYABI

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

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UNIT IV: **10 Periods**

Process overview: Development stages, Development Life cycle

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

Employability

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

Employability

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.

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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.

Employability

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.

Employability

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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.

Employability

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.

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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.

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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.

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UNIT-V: **12 Periods**

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:

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

SYLLABUS

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

EMPLOYABILITY

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.

EMPLOYABILITY

EMPLOYABILITY

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

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
2. HTML5 EMPLOYABILITY
3. CSS EMPLOYABILITY
4. PHP EMPLOYABILITY
5. Python EMPLOYABILITY
6. Content Management Systems EMPLOYABILITY
7. Joomla
8. Drupal
9. Bootstrap
10. MySql EMPLOYABILITY
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.
3. Design Login Form using HTML5.
4. Design and Develop Responsive Website using PHP and MySQl.
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

EMPLOYABILITY

LIST OF EXPERIMENTS

EMPLOYABILITY

- 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.
- 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.
- Develop and test the Technical services layer.
- Develop and test the Domain objects layer.
- Develop and test the User interface layer.

EMPLOYABILITY

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.

IT4.1.1 Object Oriented Software Engineering Credits:4

(Common with CSE 4.1.1)

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30
Univ.-Exam : 3 Hours Univ-Exam-Marks:70

1. Software Engineering:
Software related problems, software engineering, concepts, development activities
2. Modeling: Modeling
with UML
3. Project Communications:
Project communication, modes, mechanisms and activities
4. Requirements:
Requirements elicitation, concepts, activities & managing requirements elicitation
5. Analysis:
Analysis overview, concepts, activities and managing analysis
6. System Design:
Design overview, concepts, activities and managing system design
7. Object Design:
Object design overview, concepts, activities and managing object design
8. Rationale Management:
Rationale overview, concepts, activities and managing rationale
9. Testing;
Testing overview, concepts, activities and managing testing
10. Software Configuration Management:
Configuration Management overview, concepts, activities and managing configuration management
11. Project Management:
Project management overview, concepts, activities and managing project management models and activities.

Text Book:
Object-Oriented Software Engineering: Conquering Complex and Changing Systems
Bernd Bruegge and Allen H. Dutoit
Pearson Education Asia

Reference Book:
Object-Oriented Software Engineering: Practical software development using UML and Java
Timothy C. Lethbridge and Robert Laganiere
McGraw-Hill Higher education

IT4.1.2 NETWORK PROTOCOLS Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30
Univ.-Exam : 3 Hours Univ-Exam-Marks:70

IP ADDRESSING: Decimal Notation-Classes- special addresses - A simple Internet-Unicast and Broadcast addresses - Applying for IP addresses-Private networks.
SUBNETTING AND SUPERNETTING: Subnetting- Masking-Examples of Subnetting – Variable length Subnetting- Supernetting.
INTERNET PROTOCOL: Data gram-Fragmentation-Options- Checksum- IP design.
employability
ARP and RARP: ARP- ARP design – RARP
INTERNET CONTROL MESSAGE PROTOCOL: Types of Messages- Message formats- Error reporting-Query- Checksum- ICMP design.

INTERNET GROUP MANAGEMENT PROTOCOLS: Multicasting- IGMP-Encapsulation- Multicast Backbone- IGMP design.

USER DATAGRAM PROTOCOL: Process to process communication-User datagram – Checksum- UDP operation- uses of UDP – UDP design.

TRANSMISSION CONTROL PROTOCOL: Process to Process communication -TCP Services – Segment -Options- Checksum-Flow control- Error Control- TCP Timers-Connection-State Transition Diagram-Congestion Control-TCP operation- TCP Design.

APPLICATION LAYER AND CLIENT-SERVER MODEL: Client-server Model-Concurrency-Processes

employab

BOOTP and DHCP: BOOTP-DHCP

DOMAIN NAME SYSTEM: Name Space-Domain name Space-Distribution of Name space-DNS in the Internet-Resolution- DNS Messages- Types of Records-Compression-DDNS-Encapsulation.
employ

TELNET AND RLOGIN: Concept-Network Virtual Terminal- NVT character set -Embedding-Options-Option Negotiation-Sub option Negotiation-Controlling Server-Out of Band signaling –Escape character-Mode of Operation-Examples- User Interface- Rlogin-Security Issue.

FILE TRANSFER PROTOCOL: Connections- Communication-Command Processing-File Transfer-User Interface-Anonymous FTP.

TRIVIAL FILE TRANSFER PROTOCOL: Messages- Connection- Data Transfer-UDP ports- Tftp Example-TFTP options -Security-Applications.

HYPERTEXT TRANSFER PROTOCOL: HTTP overview-Proxy-Gateway-Tunnel-Cache-Messages-General Header Fields-Cache Control-Connection-Request Methods-Request Header Fields-Response Messages-Response Header Fields-Entity Header Fields-Client/Server Authentication.

SOCKET INTERFACE: Definitions-Sockets-Byte ordering- Address Transformation-Byte manipulation Function-Information about Remote Host- Socket System Calls- Connectionless Iterative server- UDP Client/Server Programs-Connection oriented Concurrent Server - TCP Client/Server Programs.

emp

Text Book: TCP/IP Protocol Suite. Behrouz A. Forouzan (TMH edition)
Reference Book: Internetworking with TCP/IP. D. E. Comer (PHI publications).
IV/IV B. Tech (IT) 1st Semester

IT4.1.3 ADVANCED OPERATING SYSTEMS Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30
Univ.-Exam : 3 Hours Univ-Exam-Marks:70

Introduction to Distributed Systems: Goals – Advantages of distributed systems over centralized systems – disadvantages of distributed systems, Hardware & Software Concepts, loosely coupled systems, network operating systems, Network file systems, design Issues – transparency – Flexibility – performance – scalability.

Network and protocols: An introduction to Computer networking , Network technologies , LAN, WAN, Protocols, Technology case study, ATM, The Client – Server Model

Remote Procedure Calling: Introduction , Features of RPC, User package, Design issues, Classes of RPC system , Interface definition language, exception handling, delivery guarantees, implementation , interface processing , binding, Locating the binder, RPC in Unix system

Synchronization in Distributed systems: Clock synchronization, Logical Clocks, Physical Clocks, Clock synchronization algorithms, Mutual exclusion, A centralized algorithms, A distributed algorithms, A token ring algorithms, comparison of the three algorithms, Election algorithms, The Bully algorithms, Ring algorithms, Dead Locks in distributed systems, Distributed deadlock detection.

Process and Processors in distributed systems: Threads, Introduction, Usage, Design issues for thread packages, An example for thread packages, System models, The workstation model, The processor pool model, The hybrid model , Processor allocation, Allocation models, Design issues, Implementation issues.

Distributed File and Directory Services: Distributed file service requirements, File service components , Flat file service , Directory Service, Client module, Design issues, implementation techniques.

Distributed shared memory Introduction: Shared memory, Consistency models, Page based Distributed shared memory, Shared – variable Distributed shared memory, Object based Distributed Shared Memory.

TEXT BOOK: Distributed Operating systems, Andrew s.Tanenbanm
Reference Book: Advanced Concepts in Operating Systems, Singhal and Niranjan G.Shivaratna

IT4.1.4 MANAGEMENT PRINCIPALES Credits:4

(Common with CSE 4.1.4)

Instruction: 3 Periods & 1 Tut. /Week — Sessional Marks: 30

Univ.-Exam : 3 Hours — Univ-Exam-Marks: **70**

1. Nature and functions of management:
   Importance of management – definition of management – management process – Roles of manager – management _ a science or art – management _ a profession.
2. Planning:
   Nature of planning – Importance of planning – Types of planning – Steps Skill Development and Entrepreneurship
3. Decision – Making:
   Meaning of decision – Types of decisions Skill development
4. Organization :
   Span of management – principles of organizing – departmentalization.
5. Authority Delegation and Decentralization :
   Source of formal authority – difference between authority and power – line and staff authority – delegation of authority – decentralization of authority.
6. Coordination:
   Need for coordination – Types of coordination – Techniques of coordination.
7. Direction:
   Requirements of effective direction – Motivation.
8. Importance of communication – Purposes of communication - Formal omm Skill development
   Informal communication – Barriers to communication – Principles of effective Communication.
9. Leadership:
   Difference between a leader and a manager – Characteristics of leadership – Functions of a leader – Approaches to leadership – Effective leadership – Leadership style in Indian organizations.
10. Managerial control :
    Steps in a control process – Need for control – Types Skill Development and Entrepreneurship sentials of Effective control systems.
11. Social Responsibilities of Business :
    Meaning of social responsibility – social responsibilities of business towards different groups.

Text Book:

Principles of Management , PC Tripathi, PN Reddy, Second Edition, Tata McGraw-Hill.

IT4.1.5 Elective -1 SATELLITE & MOBILE COMMUN ICATIONS Credits:4

Instruction: 3+1 Periods /Week | Sessional Marks: 30
Univ Exam: 3 Hours | Univ Exam Marks: 70

Principles of satellite communications: Evolution and growth of communication satellites, synchronous satellites, satellite frequency allocation and band spectrum, general and technical characteristics of satellite communication systems, advantage of satellite communication systems, active and passive satellites, advent of digital satellite communications.

Communication satellite link design: Introduction, General link design Equations, System Noise temperature, C/N and G/T ratio. Atmospheric and Ionospheric effects on link design, Uplink design, complete link design, interference effects on complete link design, earth station parameters.

Multiple Access Techniques: Introduction, TDMA, TDMA frame structure, TDMA Burst structure, TDMA frame efficiency, TDMA super frame. CDMA.

Satellite Subsystems and Global Mobile Satellite systems: Introduction, Electric power supply, attitude and orbit control, propulsion subsystem, repeaters, antenna systems, TTC subsystems, thermal control subsystems, structure subsystem, Reliability of satellite subsystems. IRIDIUM-System. The GlobalStar system, Teledesic system.

Cellular, Mobile and Personal communications: Introduction, Cellular concept and its initial implementation, Digital cellular mobile systems.

Text books:

1. Satellite communications
 -- Dr. D.C Agarwal
 khanna publishers
2. Mobile and personal communication systems and services
 -- Rajpandya.
 PHI publications

Reference Books:

1. Mobile Cellular Telecommunications
 2nd edition
 --WilliumC.Y.Lee

IT4.1.5 Elective-I EMBEDDED SYSTEMS Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30
Univ.-Exam : 3 Hours Univ-Exam-Marks:70

Introduction to embedded systems hardware needs; typical and advanced, timing diagrams, memories (RAM, ROM, EPROM). Tristate devices, Buses, DMA, UART and PLD"s. Built-ins on the microprocessor.

Interrupts basics, ISR;Context saving, shared data problem. Atomic and critical section, Interrupt latency.

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.

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, shared data.

EMPLOYABILITY

Embedded Software development tools. Host and target systems, cross compilers, linkers, locators for embedded systems. Getting embedded software in to the target system.

Debugging techniques. Testing on host machine, Instruction set emulators, logic analysers. In-circuit emulators and monitors.

EMPLOYABILITY

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

Reference Books:

1. Frank Vahid/ Tony Givargis, Embedded Systems Design – A Unified Hardware/Software Introduction, John Wiley & Sons, Inc., 2002
2. Raj Kamal, Embedded Systems, Architecture, Programming and Design, TMH, 2003

IT4.1. Elective -1 VISUAL PROGRAMMING TECHNIQUES Credits:4

Instruction: 3+1 Periods /Week — Sessional Marks: 30
Univ Exam: 3 Hours — Univ Exam Marks: 70

Visual Basic Language: Variables, Constants, Arrays, Collections, Procedures, Arguments, Function return Values, Control Flow statements, Loop statements, Nested Control structures.

Working with Forms: Appearance of forms, Designing Menus, Building Dynamic forms at runtime, Drag and Drop Operations.

Basic ActiveX Controls: The Textbox Control, The List Box and Combo Box Controls, The scrollbar and Slider Controls, The File Controls.

EMPLOYABILITY

Getting Started in Visual C++: Parts of Visual C++ program - application object – main window object , view object document object. Event oriented window programming , device context. Microsoft foundation classes an overview

EMPLOYABILITY

Event Handling : Reading keystrokes, handling mouse , creating menus, tool bars, buttons, status bar prompts, dialog box, check box, radio buttons, list boxes, combo boxes, sliders, serialization , file handling , multiple documents.

File Handling: Understanding and working with objects, controls, file handling , debugging

EMPLOYABILITY

Creating ActiveX controls: DLLs , OLE, Object technologies. Creating internet program"s using visual C++ and visual basic. Creating Active X controls. Connecting to database using VC++ and visual basic.

Text Books:

Mastering Visual Basic 6 –Evangelos Petroutsos –BPB Publications

Visual C++ 6 - Steven Holzner –BPB publications

IT4.1.5 Elective- I **COMBINATORICS & GRAPH THEORY Credits:4**

Instruction: 3 Periods & 1 Tut./week Sessional Marks: 30
Univ.-Exam : 3 Hours Univ-Exam-Marks:70

PART I: COMBINATORICS

1.FOUNDATION: Basics- Sets- Relations- Proof methods- Problem-solving strategies- Mathematical Induction.
2.COMINATORICS: Basics of counting-Combinations and Permutations- Enumeration of Combinations & Permutations without repetitions and without repetitions- with constrained repetitions- Binomial Coefficients-Binomial and Multinomial theorems- Principle of Inclusion- Exclusion
3.RECURRENCE RELATIONS: Generating Functions of Sequences- Calculating Coefficients of Generating Functions- Recurrence Relations- Solving Recurrence Relations using Substitution and Generating Functions-Method of Characteristic Roots-Solutions of homogeneous and inhomogeneous recurrence relations.

PART II GRAPH THEORY

4.FUNDAMENTAL CONCEPTS: what is a Graph-Paths-Cycles-Trails-Vertex Degrees and Counting-Directed Graphs-Trees and Distance-Spanning Trees-Enumeration-Optimization and Trees.
5.MATCHINGS AND CONNECTIVITY : Matchings and Covers-Algorithms and applications of matching-Matchings in General graphs-Cuts and Connectivity-k-connected graphs-Network flow problems.
6.COLORING AND PLANAR GRAPHS: Vertex coloring and upper bounds-Structure of k-chromatic Graphs-Enumerative Aspects-Embeddings and Euler‟s formula-Characterization of Planar graphs-Parameters of Planarity-Edges and Cycles-Line Graphs and edge-coloring-Hamiltonian Cycles-Planarity-coloring and cycles.

TEXT BOOKS:

1.J.L. Mott, Abraham Kandel & Theodore P. Baker, " Discrete mathematics for Computer Scientists & Mathematics", Prentice-Hall of India Ltd. New Delhi. (Chapters 1,2,3)
2.Douglas B. West, "Introduction to Graph Theory", Pearson Education Asia, New Delhi. (Chapters 1,2,3,4,5,6,7)

REFFERENCE BOOKS:

1. Michel Townsend, "Discrete Mathematics: Applied Combinatorics and graph theory", The Benjamin/Cummings Publishing Company", California.
2. Kenneth H Rosen. "Discrete Mathematics and Its Applications, Tata McGrahHill Publishing Company, New Delhi.
3. Robin J. Wilson, "Introduction to Graph Theory" Pearson Education Asia, New Delhi.

IT4.1.5 Elective- I RANDOM PROCESSES IN ENGINEERING Credits:4

Instruction: 3 Periods & 1 Tut./week — Sessional Marks: 30
Univ.-Exam : 3 Hours — Univ-Exam-Marks:70

1.STOCHASTIC PROCESSES:- Notion of Stochastic Process, Classification of Stochastic Process according to Time and State Space; Discrete time Morkovchains, n th step transition probabilities, stationery distribution of Morkovchains, Poisson process, Properties of Poisson; Birth and Death Process, Time dependent Birth and Death process, Renewal theory, Applications of elementary renewal theorem and key renewal theorem.

2. Stationary and Non Stationary processes:- AR Process; NA Process ; ARMA Process, ARIMA Process, Box and Jinkins Models, Correlogram analysis, Periodogram analysis, Spectrum of a Process.

3.QUEUEING THEORY:- Non Morkovchian queues, Phase type Technique, Embedded Markovchains Technique, GI/G/I Queues model, Polzak. Kintchins formula, queues with bulk arrivals queues with bulk services.

4. PRIORITY QUEUING MODELS:- Queues in Series, Queues in Parallel, Scheduling algorithms, Throughput analysis and waiting time distributions, Applications of Queuing theory in Communication Networks.

5.RELIABILITY ANALYSIS:- Concepts of Reliability, Failure Time distributions, Hazard rate functions, Reliability of a component, Bath- tub curve, System reliability, Series systems, parallel systems, Stand by redundancy, Availability , Maintainability, Fault tree constructions, Fault analysis.

REFERRENCES:

1. Probability, Statistics and Random Processes – By T.Veerarajan Tata McGraw – Hill
2. Probability and Statistics with Reliability , Queueing & Computer Science Applications – By Kishore S. Trivedi (Prentice Hall)

IT4.1.5 Elective- I ARTIFICIAL INTELLIGENCE Credits:4

Instruction: 3 Periods & 1 Tut. /Week **Sessional Marks: 30**
Univ.-Exam : 3 Hours **Univ-Exam-Marks:70**

Introduction to Artificial Intelligence, Artificial Intelligence Technique, Representation of a problem as State space search, production systems, Problem characteristics, Production System characteristics

Employability

Heuristic Search Technologies
Generate & Test Hill Climbing, Best First search, Problem reduction, Constraint satisfaction, Means Endo Analysis

Predicate Logic
Proof with Backward Chaining, Resolution, question answering.

Representing Knowledge Using Rules:
Procedural Vs Declarative knowledge, Logic Programming, Forward Vs Backward Reasoning, Matching, Control Knowledge

Employability

Symbolic Reasoning with uncertainty
Non-monotonic Reasoning, Dependency – Directed Backtracking TMS.
Statistical Reasoning with Bayes Theorem, certainty Factors & Rule Based System, DS- Theory.

Weak & Strong Slot Filler Structures
Semantic nets, Frames, Conceptual dependencies, Scripts

Planning
Block world, Components of a Planning System, Goal State Planning, Non Linear Planning, Hierarchical Planning.

Natural Language Processing
Syntactic Analysis, Semantic Analysis, Discuses and Pragmatic Processing.

Expert Systems
Representing and Using Domain Knowledge, Expert Systems Shells, Explanation

Text Books:

1. Artificial Intelligence, Rich E & Knight K – Tata Mcgrahill (1991)
2. Introduction to Artificial Intelligence & Expert Systems, Paterson. PHI

IT4.1.6 NETWORK PROGRAMMING LAB Credits:2

Instruction: 3 Periods /Week **Sessional Marks: 50**
Univ.-Exam : 3 Hours **Univ-Exam-Marks:50**

1.Identifying well known ports on a Local/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 that chat server and writes to the socket. What ever is written by one party can be seen by all other parties.

3.Data retrieval from a Remote database:
At the remote database a server listens for client connections. The server accepts SQL Queries from the client executes it on the database and sends the responses to the client.

4.Mail Client:
i)POP Client: Gives the server name, user name and password, retrieve the mails and allow manipulation of mailbox using POP commands.
ii)SMTP Client: Gives the server name, send email to the recipient using SMTP commands.

5.Simulation of Telnet:
Provide a user interface to contact well known ports so that client server interaction can be seen by the user.

6.Simple file transfer between two systems (with out protocols):
By opening socket connection to our server on one system and sending a file from one system to another.

7.HTTP Server:
Develop a HTTP server to implement the following commands.
GET, POST HEAD, DELETE.
The server must handle multiple clients.

1)Downloading Image Files from HTTP server: Using Java URL connection class (Ref. Book: Java Network Programming-Orielly)

IT4.1.8 Object Oriented Software Engineering Laboratory Credits:2

Lab: 3 Periods/week — Sessional Marks: 50
Univ.-Exam : 3 Hours — Univ-Exam-Marks:50

Computing Platform:

Each student group chooses its own platform, subject to approval by the instructor

Course Objectives:

1. They can design and implement complex software solutions using state of the art software engineering techniques.
2. The have working knowledge of UML, source control, and project management.
3. They have deep knowledge of the technologies they used for implementing their project.
4. They know how to test and document software.
5. They are capable of working as part of a software team and develop significant projects under a tight deadline.
6. They are able to present their work in a professional manner.

Topics to beCovered:

1. Software Engineering Process. EMPLOYABILITY
2. Unified Modeling Language (UML). EMPLOYABILTY
3. Data Structures and Specification.
4. Object-oriented design.
5. Debugging. EMPLOYABILITY

Syllabus Flexibility:

High. The students are free to chose a project based on the instructor's approval.

Assessment Methods:

1. Group meetings with faculty: initial proposal, code review, tracer-bullet implementation demo, final demo.
2. Design documents. Write-up.
3. Code documentation.
4. Presentations.

the students give their final presentations and demos.
Also, each project team meets individually with the instructor at least four times during the semester. The agenda for each of the four meeting is as follows:

1. Team presents project idea and has it approved by instructor. (first month)
2. design/code review. Instructor goes over design/code with the team to point out problems and formalize requirements. Instructor determines requirements for tracer-bullet implementation. (second month)

3. Tracer-bullet implementation demo. Team shows that it has achieved full vertical integration functionality. Instructor notices missed requirements and reminds students of requirements for final project.(beginning of third month).

Final meeting. Verify requirements, design, documentation, testing, write-up, division of labor, etc. (last month).

Sessional Marks Allotment: Monthly Meeting Participation: 10% Monthly Progress Reports: 15% Design/code

Document: 15% Presentation: 10%
Prototype Demonstration: 10% Final
Project Demonstration: 30% Final Project
Report: 10%

General Software Engineering Tips:

Be careful when making major modifications and keep backups! A good motto: There is no such thing as a safe software change.

One of the biggest mistakes that even professional software teams make is modifying code at the last minute. Either resist the urge to make last minute changes, or keep them isolated and well-marked so that they can be backed out easily if necessary.

Test, test, test!!! You must test your system thoroughly after making any change, no matter how small. Else you will not know if a bug was introduced! You will get no sympathy if you break your system at the last minute.

Regression Testing:

A good habit to get into: frequently run your program on an extensive test set.

Once you have a prototype, create a set of examples that your program handles correctly. Generate files of the input and the correct output as a *test set*.

When you make significant changes, run your program on the test set. If the output is different, then you will know that you‟ve introduced a bug. (Or if the output is improved, you should update the test set.)

Put together an extensive regression set! If it alerts you to one major bug (and it always does), then it is time well spent.

After verifying that a new change is "safe", save a version of your entire system! Never, EVER make changes to the saved version – it is a reliable version that you can recover in an emergency.

Documentation:

Get into the habit of documenting your code quickly as you go. If you think you‟ll remember why you did something, you are probably wrong.

Computer scientists typically hate to do documentation. One reason is that they leave it all for the end! Get into the habit of writing small comments as you go. A few comments, explaining what‟s happening and why, can make a world of difference.

When you make a change, mark it with your initials, the date, a brief explanation, and an example.

This will help enormously if the change needs to be removed or modified, and will prevent thrashing.

Working as a Team:

Be honest and realistic with your teammates when setting goals. If you fail to meet a promised deadline, it affects the whole team, not just you.

Communication is crucial! Don‟t make major decisions by yourself, and let people know when you are behind or ahead of schedule.

Try to exploit each other‟s strengths.

IT4.2.1 E-Commerce Credits:4

Instruction: 3 Periods & 1 Tut. /Week — Sessional Marks: 30
Univ.-Exam : 3 Hours — Univ-Exam-Marks:70

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.

Approaches to safe electronic Commerce – Overview – Source – Transp[illegible] – Secure Transactions – Secure Electronic Payment Protocol – Secure Electronic Transaction – Certificates for Authentication – Security on Web Servers and enterprise networks.
Electronic cash and electronic payment schemes – Internet Monitory Payment and Security requirements – payment and purchase order process – online electronic cash.

Employability

Employability

Employability

Master card/ Visa Secure electronic transaction: Introduction – Business requirements - Concepts - Payment Processing. Email and Secure Email Technologies for Electronic Commerce: Introduction – The means of Distribution – A model for Message Handling – How Does a Email Work.

Internet Resources for Commerce: Introduction – Technologies for Web Servers – Internet Applications for commerce – Internet Charges – Internet Access and Architecture – Searching the Internet.

Text Books:
Web Commerce Technology Hand Book
Daniel Minoli, Emma Minoli
McGraw Hill

Reference:
Frontiers of Electronic Commerce
Ravi Kalakotar, Andrew B.Whinston
Addison-Wesley

.

IT4.2.2 CRYPTOGRAPHY AND NETWORK SECURITY Credits:4

(Common with CSE 4.2.2)

Instruction: 3 Periods & 1 Tut. /Week — Sessional Marks: 30

Univ.-Exam : 3 Hours — Univ-Exam-Marks:70

INTRODUCTION: The need for security-security approaches-principles of security-Plain Text and Cipher Text-substitution and Transposition Techniques-Encryption and Decryption-Symmetric and Asymmetric Cryptography-Stenography-key range and key size-types of attacks

SYMMETRIC KEY CRYPTOGRAPHIC ALGORITHMS: Algorithm types and modes-overview of symmetric key cryptography-DES-IDEA-RC5-BLOWFISH-AES-Differential and Linear Cryptanalysis.

nployability

ASYMMETRIC KEY CRYPTOGRAPHIC ALGORITHMS: Overview of asymmetric key cryptography- RSA algorithm-symmetric and asymmetric key cryptography together-digital signatures-knapsack algorithm-some other algorithms.

Employability

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PUBLIC KEY INFRASTRUCTURE: Introduction-Digital certificates- Private Key management-The PKIX model-Public Key Cryptography Standards- XML, PKI and Security

Employability

INTERNET SECURITY PROTOCOLS: Basic concepts-SSL-SHTTP-TSP-SET-SSL versus SET-3D secure protocol-Electronic money-Email security-WAP security-security in GSM

Employability

USER AUTHENTICATION MECHANISMS: Introduction-Authentication basics-passwords- authentication tokens-certificate based authentication-biometrics authentication-kerberos- SSO approaches

PRACTICAL IMPLEMENTATIONS OF CRYPTOGRAPHY/SECURITY: Cryptographic solutions using Java-Cryptographic solutions using Microsoft-cryptographic toolkits-security and operating systems NETWORK SECURITY: Brief Introduction to TCP/IP- firewalls-IP security-Virtual Private Networks- case studies on cryptography and security.

Employab

TEXT BOOK:

Cryptography and Network security, Atul Kahate, Tata McGraw-Hill Pub company Ltd., New Delhi

REFERENCE BOOKS:

1) Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi

2) Network Security Essentials Applications and Standards, William Stallings, Pearson Education, New Delhi

3) Network Security: The Complete Reference by Roberta Bragg, Mark Phodes-Ousley, Keith Strassberg

Tata Mcgraw-Hill

IT4.2.3 Elective-II WAP Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30
Univ.-Exam : 3 Hours Univ-Exam-Marks:70

1.**Introduction:** What is WAP, History, Architecture and future of WAP.
2.**The user interface:** User interface basics, Text entry, using the cache, Types of WML cards, Graphics.
WAP development Tools and Software: Editors and Emulators, SDK‟s, Converting Images. Emp
3.**Working with WML:** WML basics: Writing WML code, some examples, Graphics, Templates.
Forms and User input: The Options Menu, Events, Variables, Input Tag.
Adding Functionality with WML Script: The rules of WML Script, Variables, Operators, Control Constructs, Reserved Words, Functions, The Standard Libraries, Arrays, pragmas, General coding Principles. E
4.**Database-Driven WAP:** ASP and WAP, ActiveX Data Objects (ADO), methods of converting existing HTML web site to WAP, M-Commerce and Security, Push Technology and Telematics.
5.**Sample Applications:** Currency Converter, User Directory, Scheduling, E-Commerce Employab

Text Books:
1. WAP „A beginners Guide‟--------- DALE BULBROOK
2. WAP Development with WML and WML Script------- BEN FORTA and KEITH

IT4.2.3 Elective-II MULTIMEDIA SYSTEMS Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30
Univ.-Exam : 3 Hours Univ-Exam-Marks:70

INTRODUCTION:
Definition - CD-ROM and multimedia.
Multimedia applications: business - schools - homes - public places and virtual reality. Introduction to making of multimedia: hardware - software - creativity - and organization.

MULTIMEDIA TOOLS:
Macintosh and windows production platforms - 3-d modeling and animation - image-editing tools - sound editing tools - animation - video - and digital movie tools - linking multimedia objects - office suites - word processors - spread sheets - databases - presentation tools. Authoring tools - Card and Page-based authoring tools - Icon Based authoring tools - time based authoring tools - object oriented authoring tools - cross platform-authoring tools

SKILL DEVELOPMENT

MULTIMEDIA BUILDING BLOCKS:
Text: About fonts and faces - text in multimedia - computers and text - Font editing and design tools - Hypermedia and Hypertext.
Sound: Multimedia system sounds - MIDI versus digital audio - digital audio - making MIDI audio - audio file format - working with sounds in windows - working with sounds on the Macintosh - NIFF - Adding sounds to multimedia - Towards professional sounds - production tips.
Images: -Making still images - Colors - Image file format. Animation: Principals of animation - Making animation that works. Video: How video works - Broadcast video standards - Integrating computers and television - Shooting and Editing - Video tips - Recoding formats - Digital video

SKILL DEVELOPMENT

MULTIMEDIA AND THE INTERNET:
Internet fundamentals: Internetworking - Connections - Internet services - The World Wide Web - Tools for the World Wide Web: Web serves - Web browsers - Web page makers and Site builders - Plug-ins and Delivery vehicles - Beyond HTML

DESIGNING FOR THE WORLD WIDE WEB:
Working on web - Text for web - Images for web - Sound for web - Animation for web.

TEXTBOOKS: Multimedia: Making It Work - Tay Vaughan

REFERENCE BOOKS:
1. Multimedia System Design- K. Andleigh and K. Thakkrar

2. Multimedia: Computing, Communication & Application - Ralf stein Metz and Klara Nahrstedt
3. Advanced multimedia programming - Steve Rimmer
4. Multimedia Literacy - Fred T.Hofstetter MGHill

IT4.2.3 Elective-II INTERNET AND ITS APPLICATION TECHNOLOGIES Credits:4

Instruction: 3 Periods Lec&1Tut/week   Sessional Marks: 30
Univ-Exam: 3 Hours   Univ-Exam-Marks: 70

Introducing ASP.NET: Problems with older versions of Active Server Pages, The Benefits of ASP.NET, Choosing the Appropriate Development Environment, Setting up the Development Environment.

Solutions, Projects, and the Visual Studio .NET IDE: Planning and Creating the Visual Studio .NET, Adding the Solution to Visual SourceSafe, The Visual Studio .NET integrated.

Exploring ASP.NET and Web Forms: Web Forms, Two ASP.NET Programming Models, Simple ASP.NET Page, Server Controls, View State, Post back, Responding to Events, Event Handler Procedure Arguments, Code-Behind page, life cycle of a web form and its controls, page layout

The .NET Framework and Visual Basic .NET Object Programming: Definitions, The .NET Framework, Visual Basic .NET Object-Oriented Programming, Structures, Interfaces, Enumerations, Working with Collections, Referencing External Code Libraries.

Working with Web Server Controls: The Web server control hierarchy, Label Control, TextBox Control, Button and LinkButton Control, Hyperlink control, Image and ImageButton Control, CheckBox and RadioButton Controls, DropDownList and LIstBOx Controls, Validation Controls

Using Data Bound Web Controls: Data-Binding Basics, Single Value Data Binding, Repeating Binding Control Methods, Repeating Bindin Control Events, Mapping Fields to the Control, Data Bound Controls.

Data Access with ADO.NET: Connected versus Disconnected Data, ADO.NET Data Provides, ADO. NET data Namespaces, Primary Data Objects, Modified Table Data, Using the DataGrid to modify Data, Updating the Data store, Paging the Datagrid, Storing data with the DataGrid.

Working with XML Data: XML in the .NET Framework, The XML Document Object Model, XML Namespace, XML Objects, Working with XML Documents, Validating XML Documents.

Streams, File Access and Serialization: Stream Classes, File Classes, Directory Classes, Serialization.

Text Book: ASP.NET BIBLE – Glenn Johnson- Wiley Dreamtech publications

IT4.2.3 Elective-II V H D L Credits:4

Instruction: 3 Periods & 1 Tut. /Week Sessional Marks: 30
Univ.-Exam : 3 Hours Univ-Exam-Marks:70

1. Overview of Digital Design with Vermilion HDL
2. Hierarchical Modeling Concepts
3. Basic Concepts
4. Modules and ports
5. Gate-Level Modeling
6. Dataflow Modeling
7. Behaviour Modeling
8. Tasks and Functions

Text Book:

1. Verilog HDL – A Guide to Digital Design and Synthesis, Samir Palnitkar, Pearson Education Pte. Ltd. (chapters: 1,2,3,4,5,6,7,8), 2001

Reference Books:

1. Fundamentals of Digital Logic with Verilog Design, Stephen Brown and Zvonko Vranesic, Tata - McgrawHill, 2002
2. A Verilog HDL Primer, J. Bhasker, Second Edition, Star galaxy Pub., 1999

IT4.2.3 Elective-II DATA WARE HOUSING AND DATA MINING
Credits:4

Instruction: 3 Periods & 1 Tut. /Week — Sessional Marks: 30

Univ.-Exam : 3 Hours — Univ-Exam-Marks:70

1.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.

2.Data Warehouse and OLAP Technology for Data Mining
What is a Data Warehouse? Multi-Dimensional Data Model, Data Warehouse Architecture, Data Employability
Warehouse Implementation, Development of Data Cube Technology, Data Warehousing to Data Mining

3Data Preprocessing
Why Pre-process the Data? Data Cleaning, Data Integration and Transformation
Data Reduction, Discretization and Concept Hierarchy Generation

4Data Mining Primitives, Languages and system Architectures,Data Mining Primitives: What defines a Data Mining Task?, A Data Mining query language, Designing Graphical Use Interfaces Based on a Data
Mining Query language,Architectures of Data Mining Systems

5Concept 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 Employability

6Mining 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

7Classification and prediction,Concepts and Issues regarding Classification and Prediction, Classification Employability
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

8Cluster Analysis Employability
What is Cluster Analysis? Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods

Text Book:
Data Mining Concepts and Techniques, Jiawei Han and Micheline Kamber, Morgan Kaufman Publications

Reference Books:

1. Introduction to Data Mining, Adriaan, Addison Wesley Publication
2. Data Mining Techniques, A.K.Pujari, University Press

IT4.2.4 GRAPHICS & MULTIMEDIA LABORATORY Credits:2

Lab: 3 Periods/week — Sessional Marks: 50
Univ. Exam : 3 Hours — Univ-Exam-Marks:50

Graphics: using any graphic package.

1. Drawing various types of lines and curves.
2. Creating various types text and fonts.

SKILL DEVELOPMENT

3. Creating two dimensional objects using the lines and curves
4. Animating the two dimensional pictures using transformations.
5. Coloring the pictures and Zooming.
6. Creating an object and applying animation of key framing.
7. Creating three dimensional objects using wire frame modeling.
8. Rotation, scaling and translating the 3 D objects.
9. Coloring the 3 D objects.
10. Shading the 3 D objects
11. Rendering the objects
12. Creating smooth surfaces.
13. Creating rugged surfaces based on fractal geometry.

Multimedia:

1 Preproduction & Presentation Graphics: Create a 7-10 slide presentation in your favorite presentation graphics application. (Power point is suggested; Corel Presentations 9 is free and is acceptable.)
2. Typefaces and Graphics: Create 1 vector and 1 bitmap graphic; they must be your original work created in any of the acceptable tools.
3. Desktop Publishing: Create a 2-page desktop-published "newsletter," possibly using your "What is Multimedia?" text. Include graphics.
4. Production Planning and Design: Create a proposal of project. Include summary, flowchart, element and resource lists.
5. User Interface Design & Graphics II: Create a user interface for your final project. Include 2 backgrounds and 1 button set. Aim for a cohesive look.
6. Multimedia Sound: Create 2 soundtracks and 2 EFX sounds for a previous project.
7. Digital Video: Use video capture to digitize your video shoot ro another video source to create short production (15-45 seconds)
8. Create three basic Web pages using Dreamweaver / flash or other authoring package or write bare HTML if you are able; pages must be linked and must include at least one graphic per page.

employability

Books:

2) Prabhat K. Andleigh & Kiran Thakrar, " Multimedia Systems Design", Prentice Hall of India, New Delhi.
3) Calleen Coorough, "Multimedia and the Web Creating digital Excitement", Vikas Publishing House, New Delhi.

4) James E. Shuman, " Multimedia in Action", Vikas Publishing House, New Delhi.

IT4.2.5 PROJECT WORK Credits:8

Project: 6 Periods /week Sessional Marks: 50

Univ-Exam-Marks:50

GUIDELINES for preparing the report of the Project Work

FORMAT FOR PREPARATION OF PROJECT REPORT

FOR

B. TECH.(IT)

1. ARRANGEMENT OF CONTENTS:

The sequence in which the project report material should be arranged and bound should be as follows:

1. Cover Page & Title Page
2. Bonafide Certificate
3. Abstract
4. Table of Contents
5. List of Tables
6. List of Figures
7. List of Symbols, Abbreviations and Nomenclature
8. Chapters
9. Appendices
10. References

The table and figures shall be introduced in the appropriate places.

2. PAGE DIMENSION AND BINDING SPECIFICATIONS:

The dimension of the project report should be in A4 size. The project report should be bound using flexible cover of the thick white art paper. The cover should be **printed in black letters** and the text for printing should be identical.

3. PREPARATION FORMAT:

3.1 Cover Page & Title Page – A specimen copy of the Cover page & Title page of the project report are given in **Appendix 1.**

3.2 **Bonafide Certificate –** The Bonafide Certificate shall be in double line spacing using Font Style Times New Roman and Font Size 14, as per the format in **Appendix 2.**

The certificate shall carry the supervisor‟s signature and shall be followed by the supervisor‟s name, academic designation (not any other responsibilities of administrative nature),
department and full address of the institution where the supervisor has guided the student. The term **„SUPERVISOR‟** must be typed in capital letters between the

supervisor‟s name and academic designation.

3.3 **Abstract –** Abstract should be one page synopsis of the project report typed double line spacing, Font Style Times New Roman and Font Size 14.

3.4 **Table of Contents –** The table of contents should list all material following it as well as any material which precedes it. The title page and Bonafide Certificate will not find a place among the items listed in the Table of Contents but the page numbers of which are in lower case Roman letters. One and a half spacing should be adopted for typing the matter under this head. A specimen copy of the Table of Contents of the project report is given in **Appendix 3.**

3.5 **List of Tables –** The list should use exactly the same captions as they appear above the tables in the text. One and a half spacing should be adopted for typing the matter under this head.

3.6 **List of Figures –** The list should use exactly the same captions as they appear below the figures in the text. One and a half spacing should be adopted for typing the matter under this head.

3.7 **List of Symbols, Abbreviations and Nomenclature** – One and a half spacing should be adopted or typing the matter under this head. Standard symbols, abbreviations etc. should be used.

3.8 **Chapters** – The chapters may be broadly divided into 3 parts (i) Introductory chapter, (ii) Chapters developing the main theme of the project work (iii) and Conclusion.

The main text will be divided into several chapters and each chapter may be further divided into several divisions and sub-divisions.

- Each chapter should be given an appropriate title.
- Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they are cited.
- Footnotes should be used sparingly. They should be typed single space and placed directly underneath in the very same page, which refers to the material they annotate.

3.9 **Appendices** – Appendices are provided to give supplementary information, which is included in the main text may serve as a distraction and cloud the central theme.

- Appendices should be numbered using Arabic numerals, e.g. Appendix 1, Appendix 2, etc.
-

Appendices, Tables and References appearing in appendices should be numbered and referred to at appropriate places just as in the case of chapters.

 Appendices shall carry the title of the work reported and the same title shall be made in the contents page also.

3.10 List of References –The listing of references should be typed 4 spaces below the heading "REFERENCES" in alphabetical order in single spacing left – justified. The reference material should be listed in the alphabetical order of the first author. The name of the author/authors should be immediately followed by the year and other details.

A typical illustrative list given below relates to the citation example quoted above.

REFERENCES

1. Ariponnammal, S. and Natarajan, S. (1994) „Transport Phonomena of Sm Sel – X Asx‟, Pramana – Journal of Physics Vol.42, No.1, pp.421-425.

2. Barnard, R.W. and Kellogg, C. (1980) „Applications of Convolution Operators to Problems in Univalent Function Theory‟, Michigan Mach, J., Vol.27, pp.81–94.

3. Shin, K.G. and Mckay, N.D. (1984) „Open Loop Minimum Time Control of Mechanical Manipulations and its Applications‟, Proc.Amer.Contr.Conf., San Diego, CA, pp. 1231-1236.

3.10.1 Table and figures - By the word Table, is meant tabulated numerical data in the body of the project report as well as in the appendices. All other non-verbal materials used in the body of the project work and appendices such as charts, graphs, maps, photographs and diagrams may be designated as figures.

4. TYPING INSTRUCTIONS:

The impression on the typed copies should be black in colour.

One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style „Times New Roman‟ and Font size 14.

* * * * *

(A typical Specimen of Cover Page & Title Page)
<Font Style Times New Roman – Bold>

TITLE OF PROJECT REPORT

<Font Size 18><1.5 line spacing>

A PROJECT REPORT
<Font Size 14>

Submitted by
<Font Size 14><Italic>

NAME OF THE CANDIDATE(S)
<Font Size 16>

in partial fulfillment for the award of the degree

of

<Font Size 14><1.5 line spacing><Italic>

BACHELOR OF TECHNOLOGY
<Font Size 16>

IN

INFORMATION TECHNOLOGY
<Font Size 14>

DEPARTMENT OF COMPUTER SCIENCE AND SYSTEMS ENGINEERING
<Font Size 12>
ANDHRA UNIVERSITY AUTONOMOUS COLLEGE OF ENGINEERING
< Font Size 14>
ANDHRA UNIVERSITY : VISAKHAPATNAM - 530003

<Font Size 16><1.5 line spacing>

MONTH & YEAR

<Font Size 14>

SPECIMEN

SOME PERFORMANCE ASPECTS CONSIDERATIONS OF A CLASS OF ARTIFICIAL NEURAL NETWORK

A PROJECT REPORT

Submitted by

SANDHY. A

GAYATHRI. R

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

in

INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND SYSTEMS ENGINEERING

ANDHRA UNIVERSITY AUTONOMOUS COLLEGE OF ENGINEERING

ANDHRA UNIVERSITY:: VISAKHAPATNAM-530 003

MAY 2005

(A typical specimen of Bonafide Certificate)
<Font Style Times New Roman>

ANDHRA UNIVERSITY : VISAKHAPATNAM-530 003

<Font Style Times New Roman – size -18>

BONAFIDE CERTIFICATE

<Font Style Times New Roman – size -16>

<Font Style Times New Roman – size -14>

Certified that this project report **"………TITLE OF THE PROJECT…………….."** is the bonafide work of "**…………..NAME OF THE CANDIDATE(S)…………"** who carried out the project work under my supervision.

<<Signature of the Head of the Department>>	<<Signature of the Supervisor>>
SIGNATURE	**SIGNATURE**
<<Name>>	<<Name>>
HEAD OF THE DEPARTMENT	**SUPERVISOR**
	<<Academic Designation>>
<<Department>>	<<Department>>
<<Full address of the Dept & College >>	<<Full address of the Dept & College >>

(A typical specimen of table of contents)
<Font Style Times New Roman>

TABLE OF CONTENTS

APPLIED PHYSICS

(for ECE, EEE &Mech)

ECE122 **Credits :3**

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

End .Exam :3 Hours End-Exam-Marks:60

CourseObjectives:

- To enhance student's knowledge of theoretical and modern technological aspects in physics and to introduce fundamentals of physics relevant to engineering applications
- To introduce advances in technology for engineering applications

Course Outcomes:

By end of the course, student will be able to:	
1.	Correlate the theoretical principles with experimental observations
2.	Identify engineering materials for specific engineering applications
3.	Apply the knowledge of advanced materials for engineering applications

SYLLABUS

UNIT I

Magnetic materials: Definition of magnetic permeability, magnetization and magnetic susceptibility, origin of magnetic moment, classification of magnetic materials, properties of diamagnetic and paramagnetic materials, ferromagnetic materials - hysteresis curve , domain theory of ferromagnetism, soft and hard ferromagnetic materials, anti-ferromagnetic and ferrimagnetic materials , ferrites and its applications

Superconductivity: Introduction, properties of superconductors, effect of temperature and magnetic field, Meissner effect, flux quantization , type – I and type – II superconductors high temperature superconductors, applications of superconductors, BCS theory (qualitative)

UNIT II

Dielectric materials: Definition of electric dipole moment, dielectric polarization and dielectric constant, types of polarization – electronic, ionic and oriental polarization, expression for polarisability, internal fields in solids, Classius – Mossotti equation, frequency dependence of electronic polarization ,properties of ferroelectric materials and their applications

UNIT III

Nanophase materials: Introduction to nanophase materials, properties of nanophase materials, synthesis of nanophase materials – chemical vapour deposition, sol-gel method, MEChanical attrition method, applications of nanophase materials. Principles of X-Ray florescence X-Ray Diffraction- Electron Microscopy (SEM and TEM)

UNIT IV

Crystal structure: Introduction, fundamental terms of crystallography – space lattice, , crystal lattice, unit cell, planes, seven crystal systems – Bravias lattices, cubic lattices, crystal directions and planes, Miller indices, interplanar spacing and interatomic distance , some simple crystal structures, body-centered cubic crystals, face-centered cubic crystals

UNIT V

Semiconductor Physics: Intrinsic and extrinsic semiconductors, Fermi level, carrier concentration in intrinsic semiconductor, continuity equation, direct and indirect band gap semiconductors. Lorentz force, Hall effect and its applications.

Physics of semiconductor devices: open circuited p-n junction diode, energy diagram of p-n diode, working of a diode, volt-ampere characteristics of p-n junction, diode as a rectifier, light emitting diode (LED) , liquid crystal display (LCD), photodiode

TEXTBOOKS:

1. S.L Gupta and SanjeevGupta*Engineering physics*DhanpatRai publications.
2. M.N. Avadhanulu&P.G.Kshirasagar*A text book of engineering physics*, S.Chand publication

REFERENCE BOOKS:

1. V.Rajendran*Engineering physics* Tata McGraw Hill Education Private Limited
2. DattuRamanlal Joshi *Engineering Physics* Tata McGraw Hill Education Private Limited
3. A.Marikani*Engineering Physics* PHI Learning Private Limited

OBJECT ORIENTED PROGRAMMING WITH C++ LAB

(Common for all branches)

ECE 128 **Credits:3**

Instruction : 1Tut/Week & 3Practical / week Sessional Marks :50

End Exam:3Hrs End Exam. Marks : 50

Course Objective:

- To introduce Object Oriented Programming (OOP) using the C++ Language.
- To provide the basic concepts and techniques which form the Object Oriented Programming paradigm.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Understand how to use the programming constructs of CPP.
2.	Use Object Oriented Programming concepts to develop object oriented programs.
3.	Apply various object oriented features to solve real world computing problemsusing C++ language.

SYLLABUS:

List of the experiments to be done on the following topics

1. Overview (Transition from C)
2. OOP Concepts and Characteristics,
3. Preprocessor , Command line arguments
4. Classes & Data Abstraction,
5. Objects,
6. Operator Overloading,
7. Inheritance,
8. Virtual Functions & Polymorphism,
9. I/O Streams,
10. Templates,
11. File Processing,
12. Exception Handling Concepts

REFERENCE BOOKS:

1. Mahesh Bhave , Sunil patekar*Object Oriented Programming in C++* Second edition , Pearson
2. R Rajaram, *Object Oriented Programming in C++* 2nd Edition New Age International Publishers
3. Herbert Schildt*C++ the Complete Reference* III edition, TMH 1999
4. E Balaguruswamy*Object Oriented Programming with C++*3rd Edition , McGraw Hill

LIST OF SAMPLE PROGRAMS

1. Write a C++ program that uses a recursive function for solving Towers of Hanoi problem.

2. Write a C++ program to find both the largest and smallest number in a list of integers.

3. Write a C++ program that uses function templates to solve problems 1 and 2 experiments

4. Write a C++ program to implement the matrix ADT using a class. Use operator overloading for implementation

5. Write the definition for a class called **Rectangle** that has floating point data members length and width. The class has the following member functions:
   void setlength(float) to set the length data member
   void setwidth(float) to set the width data member
   float perimeter() to calculate and return the perimeter of the rectangle
   float area() to calculate and return the area of the rectangle
   void show() to display the length and width of the rectangle
   intsameArea(Rectangle) that has one parameter of type Rectangle. sameArea returns 1 if the two Rectangles have the same area, and returns 0 if they don't.
   1. Write the definitions for each of the above member functions.
   2. Write main function to create two rectangle objects. Set the length and width of the first rectangle to 5 and 2.5. Set the length and width of the second rectangle to 5 and 18.9. Display each rectangle and its area and perimeter.
   3. Check whether the two Rectangles have the same area and print a message indicating the result. Set the length and width of the first rectangle to 15 and 6.3. Display each Rectangle and its area and perimeter again. Again, check whether the two Rectangles have the same area and print a message indicating the result

6. Create a class called MusicIns to contain three methods string(),wind() and perc(). Each of these methods should initilialize string array to contain the following
   i. Veena, guitear, sitar, sarod and mandolin under string
   ii. Flute, clarinet, saxophone, nadaswaram and piccolo under wind
   iii. Table, mridangam, bangos, drums and tambour under perc

   It should also display the contents of the arrays initialized , create a sub class call TypeIns to contain a method called get() and show(). The get() methods must display a menu as follows

   - String instruments
   - Wind instruments
   - Percussion instruments

   The show method should display the relevant details according to user choice .the base class variable must be accessible only to its derived classes.

7. Create a base class called shape. It should contain two methods getCoord(), showCoord() to accept x and y co ordinates and to display the same respectively . Create a sub class called Rect. It should contain method to display length and breadth of the rectangle called showCoord() . In main method, execute the showCoord() of Rect class by applying the dynamic method dispatch concept

8. Create a class called car. Initialize the color and body attributes to “blue” and “wagon”. there should be two constructors one is a default the creates blue wagon the other constructor should take two argcolor, body and initialize. write method toString() that returns the color and body. Create a sub class funcar. In sub class there are two constructors to invoke super class constructors resp. Write a method playCD in sub class that displays the message “Beautiful music fills the passenger compartment” execute the methods to show the messages
    1. Mycar is a blue wagon
    2. My father’s car is red convertible.

9. Create the ZooAnimal constructor function. The function has 4 parameters -- a character string followed by three integer parameters. In the constructor function dynamically allocate the name field (20 characters), copy the character string parameter into the name field, and then assign the three integer parameters to cageNumber, weightDate, and weight respectively.
10. Write a C++ program to perform operations on complex numbers using operator overloading
11. Write a C++ program to write number 1 to 100 in a data file NOTES.TXT

12. Write a function in C++ to count and display the number of lines not starting with alphabet 'A' present in a text file "STORY.TXT".
    Example:
    If the file "STORY.TXT" contains the following lines,
    The rose is red.
    A girl is playing there.
    There is a playground.
    An aeroplane is in the sky.
    Numbers are not allowed in the password.

    The function should display the output as 3

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.

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).

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.

EMPLOYABILITY

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 **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.

Skill Development

UNIT-II

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.

Skill Development

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, 4th Edition, TMH Publication.

ELECTRONIC CIRCUITS AND ANALYSIS-I	
ECE 216	**Credits:4**
Instruction: 4 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	Determine the performance parameters like current gain, voltage gain, input impedance, output impedance using the models such as h-parameter model, simplified CE h – parameter model and **π-**model.
2	Analyze the frequency response characteristics of single stage and multistage amplifier circuits (i.e. given a lower cut off, upper cut-off frequencies of an amplifier determining the coupling and bypass capacitor values) and different circuit configurations for improving the transistor amplifier characteristics such input impedance, voltage gain etc.
3	Analyze the response of linear wave shaping circuits such as high pass and low pass filter circuits for different types of inputs such as step input, pulse input, square input ramp input.
4	Analyze the response of Non-linear wave shaping circuits such as clipping and clamping circuits when the sinusoidal input is applied and to design two level clipping circuits in order to select the desired portion of the input signal.
5	Determine the stable state voltages and currents and design the various multivibrators to meet the given specifications.

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	2	-	-	-	-	-	-	-	-	-		-	2
	3	3	2	-	-	-	-	-	-	-	-	-	-		-	-
	4	3	2	-	-	-	-	-	-	-	-	-	-		-	-
	5	3	2	2	-	-	-	-	-	-	-	-	-		-	2

SYLLABUS

Unit-I

Transistor at low frequencies and high frequencies **12 periods**

Graphical analysis of CE configuration, Two port devices and hybrid model, Transistor hybrid model, h-parameters, conversion formulas of three transistor configurations, Analysis of transistor amplifier circuit using h-parameters, the emitter follower, Millers theorem and its dual, cascading transistor amplifiers, simplified CE hybrid model, high input resistance transistor circuits, hybrid- π CE transistor model, hybrid- π conductance, hybrid- π capacitances, validity and variation of hybrid- π parameters.

SKILL DEVELOPMENT

Unit-II

Multistage Amplifiers **8 periods**

Classification of amplifiers, Distortion in amplifiers, Frequency response of an amplifier, The RC coupled amplifier-low frequency response, high frequency response of two cascaded CE stages, Band- pass of cascaded stages, Cascode amplifiers, Multistage CE amplifier cascade at High frequencies.

Unit-III

Linear wave shaping **12 periods**

The high pass RC circuit, High pass RC circuit as a differentiator, Double differentiation, The low pass RC circuit, Low pass RC circuit as an integrator, attenuators, RL and RLC circuits.

Unit-IV

Clipping and Clamping Circuits **12 periods**

Diode Clippers, The transistor clipper, Clipping at two independent levels, Cathode coupled and emitter coupled clipper, Compensation for temperature changes, comparators, breakaway diode and amplifier, diode differentiator comparator, accurate time delays, applications of voltage comparator, The clamping operation, clamping circuit taking source and diode resistance into account, Clamping circuit theorem, Practical clamping circuits, effect of diode characteristics on clamping voltage, Synchronized clamping.

SKILL DEVELOPMENT

Unit-V

Multivibrators **12 periods**

Stable stages of a binary, fixed bias transistor binary, self bias transistor binary, commutating capacitors, methods of improving resolution, emitter coupled binary, Schmitt trigger circuit, the monostable multivibrator, emitter coupled monostable multivibrator, astable emitter coupled multivibrator.

SKILL DEVELOPMENT

Text Books:

1. Jacob Millman, Christos Halkias, Chetan Parikh, "Integrated Electronics", 2nd Edition, McGraw Hill Publication, 2009.[unit1,unit2]
2. Jacob Millman & Herbert Taub, "Pulse Digital & Switching Waveforms" McGraw-Hill Book Company Inc.[unit3,unit4,unit5]

References:

1. Donald A. Neamon, "Electronic Circuit Analysis and Design", 2nd Edition. TMH publications.

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

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.

Skill Development

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.

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

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.

Skill Development

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

Skill Development

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 DEVELOPMENT

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", 2^{nd} 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

Text Books:

1. Rudra Pratap, “Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers ” Oxford 2010.

Skill development

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

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

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.

Employability

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.

Employability

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

Employability

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.

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.

Employability

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

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

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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

EMPLOYABILITY

UNIT IV : **9Periods**

Memory Organization

Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory

EMPLOYABILITY

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

EMPLOYABILITY

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”, 4th 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

List of Experiments

Experiments using 8085 Microprocessor trainer:

Employability

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: Employability

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 Employability
12) Interfacing of stepper motor
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:

Skill development/ Employability

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.

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.

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.

Employability

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
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**

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

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

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

Employability

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

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

B.E. 4th Year 1st Semester (Credit Based Grading System) with effect from the admitted batch of 2006 - 2007

ECE 411 DIGITAL SIGNAL PROCESSING

Credits	*Periods*			*Exam Hrs.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES

1. This course will introduce the basic concepts and techniques for processing signals on a computer.
2. The most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.
3. The course emphasizes intuitive understanding and practical implementations of the theoretical concepts.

COURSE OUTCOMES

By the end of the course student will be able to	
1.	Acquire knowledge about discrete-time sequences, concept of energy and power, periodicity.
2.	Acquire knowledge about DFT and FFT
3.	Design and realize FIR and IIR using different techniques.
4.	Acquire knowledge on various applications of Digital Signal Processors in speech processing and radar signal 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	3	3	2	-	-	_	_	_	_	-	-	1		3	1
	2	3	3	3	-	-	_	_	_	_	-	-	1		3	1
	3	3	3	2	-	-	_	_	_	_	-	-	1		3	1
	4	3	3	2	-	-	_	_	-	-	-	-	1		3	1
	5	3	3	2	-	-	_	_	_	_	-	-	1		3	1

1. Discrete - Time Signals and Systems:

   Discrete - Time Signals – Sequences, Linear Shift – Invariant Systems, Stability and Casuality, Linear Constants – Coefficient Difference Equations, Frequency Domain Representation of Discrete – Time Signals and Systems.

2. Applications of Z – Transforms:

   System Functions H(z) of Digital Systems, Stability Analysis, Structure and Realization of Digital Filters, Finite Word Length Effects.

3. Discrete Fourier Transform (DFT):

   Properties of the DFS, DFS Representation of Periodic Sequences, Properties of DFT, Convolution of Sequences.

4. Fast – Fourier Transforms (FFT):

   Radix – 2 Decimation – In – Time (DIT) and Decimation – In – Frequency (DIF), FFT Algorithms, Inverse FFT.

5. IIR Digital Filter Design Techniques:

   Design of IIR Filters from Analog Filters, Analog Filters Approximations (Butterworth and Chebyshev Approximations), Frequency Transformations, General Considerations in Digital Filter Design, Bilinear Transformation Method, Step and Impulse Invariance Technique.

6. Design of FIR Filters:

   Fourier Series Method, Window Function Techniques, Comparison of IIR and FIR Filters.

7. Applications:

   Applications of FFT in Spectrum Analysis and Filtering, Application of DSP in Speech Processing.

Text Book:

1 Alan V. Oppenheim and Ronald W. Schafer: Digital Signal Processing, PHI.

References:

1. Sanjit K. Mitra, Digital Signal Processing "A – Computer Based Approach", Tata Mc Graw Hill.
2. Raddar and Rabiner, Application of Digital Signal Processing.
3. S. P. Eugene Xavier, Signals, Systems and Signal Processing, S. Chand and Co. Ltd.
4. Antonio, Analysis and Design of Digital Filters, Tata Mc Graw Hill.

ECE 412 INFORMATION THEORY AND CODING

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES

1 To understand the Information capacity of channel by studying the concept of Information theory

2 To know the efficient representation sources by providing source coding techniques.

3 To provide knowledge about error detection and correction, different types of channel coding techniques such as linear block codes, cyclic codes and convolution codes are to be discussed.

COURSE OUTCOMES

By the end of the course student will be able to	
1	Understand the fundamental concepts of information theory, channel capacity and error control coding.
2	Solve the source coding problems and understand the compact description of sources.
3	Solve the various channel coding and decoding problems.
4	Analyze the performance of various coding techniques applied in communication 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	2	-	-	-	-	-	-	-	2			
	2	2	-	2	3	-	-	-	-	-	-	-	2			
	3	2	-	2	3	-	-	-	-	-	-	-	2			
	4	2	-	2	2	-	-	-	-	-	-	-	2			
	5	2	-	2	2	-	-	-	-	-	-	-	2			

1. Information measure and source coding, Information measure, Entropy and Information rate, Coding for a discrete memory less source, Predictive coding for sources with memory, Information transmission on discrete channels, Mutual information.

   Discrete channel capacity, coding for the binary symmetric channel, Continuous channels and system comparisons , continuous information, continuous channel capacity, Ideal communication system , system comparisons.

2. Rationale for coding , and types of codes, Discrete memory less channels, linear block codes , cyclic codes, convolution codes, Maximum likely hood Decoding of Convolution codes, Distance properties of convolution codes.

   Sequential Decoding of Convolution codes, Trellis codes, Applications , Algebraic codes, Burst error correcting, Parity check bit coding for error detection, comparison of error rates in coded and un coded transmission, Automatic repeat request.

Employability

Text Books:

1) Communication Systems,3/e, by A.B. Carlson, Mc. Graw Hill Publishers(for topic1)
2) Digital Communications by Simon Haykin , John Wiley & Sons(for topic 2)

References:

1) Principles of Digital Communications, Signal representation, Detection , Estimation &Information
2) Coding by J Das, S.K. Mullick, P.K.Chatterjee, New Age Int. Ltd.
3) Principles of Communication Systems, Taub &Schilling, 2/e, TMH Publishers

ECE 413 TV AND SATELLITE COMMUNICATION

Credits	*Periods*			*Exam Hrs.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES

1. To familiarize the students about the TV Principles and Broadcasting requirements.
2. To study the analysis and synthesis of TV pictures, composite video signal, camera tubes and picture tubes.
3. To familiarize the students about the satellite orbits, its launching methods, earth segment and space segment components.
4. To provide knowledge about the overview of satellite systems in relation to other terrestrial systems & its contribution to overall technical growth.

COURSE OUTCOMES

By the end of the course student will be able to	
1.	Understand the Television principles.
2.	Describe about different camera tubes & picture tubes.
3.	Explain television broadcasting.
4.	Implement the satellite link budgets and describe the orbital aspects and tracking of the communication satellites.
5.	Distinguish various multiple access techniques used in space communication & discuss about earth station technology.

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	2	-	-	-	-	-	-	1	-	1	1	-	-
	2	1	1	2	-	-	-	-	-	-	1	-	1	-	-	-
	3	1	1	2	-	-	-	-	-	-	1	1	2	1	-	-
	4	2	3	3	-	-	-	-	-	-	1	1	3	1	1	-
	5	1	1	1	-	-	-	-	-	-	1	-	1	1	-	-

Television

Basic Television System:

Sound and Picture Transmission, the Scanning Process, Interlaced Scanning, Number of Scanning Lines, Vertical and Horizontal Resolution, Bandwidth of the Baseband Picture Signal.

Television Cameras:

Principle of working and constructional details of Image Orthicon, Vidicon, Plumbicon and Silicon diode array Vidicon and Solidstate Image Scanners.

Composite - Video Signal:

Video signal levels, Need for Synchronization, Details of Horizontal and Vertical Sync Pulses, Equalizing Pulses.

Signal Transmission and Channel Bandwidth:

AM and FM Channel Bandwidth, VSB Transmission, Complete Channel Bandwidth, Reception of Vestigial Sideband Transmission, Television Standards, Block Schematic study of a typical TV Transmitter.

The TV Picture Tube:

Monochrome Picture Tube, Picture Tube Characteristics and Picture Tube Control Circuits, Gamma Correction.

Television Receiver:

Block Schematic and Functional Requirements, VSB Correction, Vertical and Horizontal Deflection Circuits, E.H.T. Generation, Study of Video IF Amplifier Video Detector, Sound Channel Separation, Sync Separation Circuits.

Colour Television:

Principles of Additive and Subtractive Colour Mixing, Chromaticity Diagram, Compatibility and Reverse Compatibility of Colour and Monochrome TV Requirements, Colour Signal Transmission, Bandwidth for Colour Signal Transmission, Sub-carrier Modulation of Chroma Signals, NTSC Encoding (Y, I, Q signals), PAL Encoding (Y, U, V signals), NTSC and PAL Decoders, Types of Colour TV Picture Tubes (Delta-gun, PIL and Trinitron Picture Tubes), Convergence Techniques.

Satellite Communication

Orbital Aspects, Tracking and Control of Communication Satellites, Launch Vehicles, Propagation Characteristics: Attenuation and Noise, Frequency Bands, Satellite Transponders, Earth Station: Configuration, High Power Amplifiers, Antennas, LNA, Link Design, Multiple Access: FDMA, TDMA, CDMA, SPADE, INTELSATs, INSAT.

Text Books:

1. Monochrome and Colour Television, R. R. Gulati, Wiley Eastern.

References:

1. Television Engineering, A. M. Dhake, Tata - McGraw Hill.
2. Satellite Communication, D. C. Agarwal, Khanna Publishers.
3. Satellite Communication, T. Pratt and S. W. Bostian, John Wiley and Sons.

ECE 414 MICROWAVE ENGINEERING

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES

1. To understand the theoretical principles underlying microwave devices and networks.
2. To calculate the 'S' matrix for different microwave devices and circuits.
3. To work with different microwave bench setups and to perform different microwave measurements.
4. To understand various microwave sources and amplifiers.

COURSE OUTCOMES

C404.1	Able to apply electromagnetic theory to calculations regarding w transmission lines.
C404.2	Able to understand different microwave amplifiers and sources
C404.3	Able to describe, analyze and design simple microwave circuits and devices S- parameters.
C404.4	Able to understand the necessity of MMICS and their fabrication procedure
C404.5	Able to handle microwave equipment and make measurements

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															
	3															
	4															
	5															

1. Microwave Components:

   Introduction to Microwaves and their applications, Coaxial Line Components, Wave-guide Components, Directional Couplers, Hybrid Tee Junction, Magic Tee, Attenuators, Ferrite Devices, Isolators, Circulators, Cavity Resonators, Re-entrant Cavities, Wave-meters, Microwave Filters, Detectors, Mixers.

2. Microwave Signal Generators and Amplifiers:

   Vacuum Tube Triodes, Resonant Cavity Devices, Reflex Klystron, Two – Cavity Klystron, Multi – Cavity Klystron, Slow – Wave Devices, TWT,

Employability

Employability

Crossed Field Devices, Magnetrons, Semiconductor Devices, Microwave BJTs, FETs, Tunnel Diodes, Gunn Diode, IMPATT, TRAPATT Diodes.

3. Microwave Circuits:

   Scattering Matrix and its Properties, Scattering Matrix of directional coupler, circulator, E Plane Tee, H plane Tee and Magic Tee.

Employability

4. Microwave Integrated Circuits:

   Materials, Substrate, Conductor, Dielectric and Resistive Materials, MMIC Growth, Fabrication Techniques, MOSFET Fabrication, NMOS Growth and CMOS Development, Thin Film Formation.

5. Microwave Measurements:

Employability

   VSWR, Frequency, Guide Wavelength, Coupling and Directivity measurements.

Employability

Text Books:

1. "Microwave and Radar Engineering" by Gottapu Sasi Bhushana Rao, ISBN – 978813179944 Pearson Education Chennai 2013.
2. Microwave Engineering, G.S.N. Raju, IK International Publishers,

References:

1. Foundations For Microwave Engineering, R. R. Collin, McGraw Hill.
2. Microwave Communications – Components and Circuits, E. Hund, McGraw Hill.
3. Microwave Devices and Circuits, S. Y. Liao, PHI.

4. Microwave Engineering, R. Chatarjee, East – West Press Pvt. Ltd.

ECE 415 Elective – III (1) : CELLULAR AND MOBILE COMMUNICATIONS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES

1. To have an overview of analog and digital cellular systems in wireless and mobile communications in different generations with the role of techno-political aspects in allocation of the limited wireless spectrum.
2. To understand the cellular radio concepts such as frequency reuse, handoff and how interference between mobiles and base stations affects the capacity of cellular systems.
3. To understand of different propagation models, and different antennas used in mobile environment.
4. To develop the ability to present information on current and future cellular mobile communication systems based on dropped calls and operational techniques.

COURSE OUTCOMES

By the end of the course student will be able to	
1.	Solve problems related to principle of operation of cellular mobile systems, interference, types of handoffs and dropped calls
2.	Solve problems related to Cell coverage of signal and traffic, cell size antennas and mobile antennas
3.	Design and analyze real time co-channel and non-co channel interference types, operational techniques
4.	Design and analyze frequency management and channel assignment, Elements of cellular radio system design

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								1	1	3	1	1
	2	2	1	1								1	1	3	1	1
	3	2	2	1								2	2	3	2	1
	4	2	2	1								3	3	1	2	1

Introduction to Cellular Mobile Systems:

A basic Cellular System, Performance Criteria, Uniqueness of Mobile Radio Environment, Operation of Cellular Systems, Planning and Cellular Systems, Analog & Digital Cellular Systems.

Elements of Cellular Radio System Design:

General description of the problem, Concept of Frequency Channels, Co-channel interference Reduction factor, Desired C/I from a normal case in an Omni-directional Antenna system, Cell splitting, consideration of the components of

Cellular Systems.

Interference:

Introduction to Co-channel interference, Real time Co-channel interference, Co-channel measurement, Design of Antenna system, Antenna parameters and their effects, Diversity Receiver, Non Co-channel interference - different types.

Cell Coverage for Signal and Traffic:

General introduction, Obtaining the Mobile Point - to - Point model, Propagation over water or flat open area, Foliage loss, Propagation in near in distance, Long distance Propagation, Point - to - Point predication model - characteristics, Cell site, Antenna heights and signal coverage cells, Mobile - to - Mobile Propagation.

Cell Size Antennas and Mobile Antennas:

Characteristics, Antennas at Cell site, Mobile Antennas.

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.

Operational Techniques:

Parameters, Coverage hole filter, Leaky feeders, Cell Splitting and small cells, Narrow Beam concept.

Text Books:

Mobile Cellular Communication by Gottapu Sasibhushana Rao,

Pearson International, 2012.

Reference Books:

Cellular and Mobile Communications by Lee, McGraw Hill.
Wireless Digital Communication by Dr. Kamilo Feher, PHI.

ECE 415 Elective – III (2) : VLSI DESIGN AND EMBEDDED SYSTEMS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES

1. Outline the mathematical methods and circuit analysis models in analysis of NMOS, CMOS digital electronics circuits, including logic components and their interconnect.
2. Description of the characteristics of NMOS, CMOS circuit construction.
3. Introduce the concepts and techniques of modern integrated circuit design and testing.
4. Description about NMOS, CMOS combinational and sequential logic at the transistor level, including mask layout.
5. Description about general steps required for processing of NMOS, CMOS integrated circuits.
6. Students have knowledge about Designing of functional units including adders, multipliers, ROMs, SRAMs, and PLAs.
7. Students have knowledge about the basic functions, basic structure, basic concepts and applications of embedded systems.

COURSE OUTCOMES

C405.1	Be able to use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnect.
C405.2	Be able to create models of moderately sized CMOS circuits that realize specified digital functions.
C405.3	Be able to apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects.
C405.4	Have an understanding of the characteristics of CMOS circuit construction and the comparison between different state-of-the-art CMOS technologies and processes.
C405.5	Be able to complete a significant VLSI design project having a set of objective criteria and design constraints.
C405.6	An ability to design a system, component, or process to meet desired

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															
	3															
	4															
	5															

	needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

1. Review of microelectronics and an introduction to MOS technology:
   Introduction to IC technology, MOS and related VLSI technology, NMOS, CMOS, BiCMOS Technologies, Thermal aspects of processing, Production of E beam marks.
2. MOS and BiCMOS circuit design processes:
   MOS layers, ,Stick diagrams, Design rules, and layout, 2 & 1.2 micro meter CMOS rules, Layout diagrams, Symbolic diagram.

   EMPLOYABILITY
3. Basic Circuit concepts:
   Sheet resistance, Area capacitances of layers, Delay unit, Wiring Capacitances, Choice of layers.
4. Scaling of MOS Circuits:
   Scaling models, Scaling function for device parameters, Limitations of scaling.
5. Sub system design and Layout:
   Architectural issues, Switch logic, Examples of Structural design(Combinational logic).

   EMPLOYABILITY
6. Sub system design process:
   Design of ALU subsystem, Some commonly used storage elements, Aspects of design tools, Design for testability, Practical design for test guidelines, Built in self test, CMOS project-an incrementer / decrementer, a comparator for two n-bit numbers.

   EMPLOYABILITY

   Ultra fast systems, Technology development, MOSFET based design.
7. Introduction to Embedded Systems
   Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software in a System, Examples of Embedded Systems, Embedded Systems on Chip, Complex Systems Design and Processors, Design Process in Embedded System, Formalization of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skills required for an Embedded

System Designer.

8. Embedded Software Development Process and Tools
   Introduction to Embedded Software Development Process and Tools, Host and Target Machines, Linking and Locating Software, Getting Embedded Software into the Target System, Issues in Hardware-Software Design and Co-design

Text books:

1. Basic VLSI Design by Douglas A, Pucknell, Kamran Eshraghian, Prentice-Hall, l996, 3rd Edition.
2. Embedded Systems Architecture, Programming and Design, second edition by Raj Kamal, Tata McGraw Hill Publication (Chapter 1, Chapter 13)

References:

1. Mead, C.A and Conway, LA, "Introduction to VLSI Systems", Addison-Wesley, Reading, Massachusetts, 1980.

ECE 415 Elective – III(3) : ADVANCED MICROPROCESSORS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
4	3	1	-	3	30	70	100

8086 / 8088 microprocessor, architecture and addressing modes.

Instructions and assembly language programming.

Macroassembler MASM and advanced programming.

Interrupts of 8086 / 8088 and DOS Interrupt 21h functions.

Interfacing A/D converters to the PC and data acquisition. Interfacing D/A converters and waveform generation.

80286, 80386, 80486 and Pentium microprocessors.

Motorola 68000, 68020 and 68030 microprocessors.

Text Books:

1. Microprocessor and Interfacing by Douglas V. Hall, McGraw Hill International Edition, 1992.
2. The Intel Microprocessor 8086 / 8088, 80186, 80286, 80386 and 80486 by Barry B. Brey, PHI, 1998.
3. 68000 Microprocessors by Walter A. Tribel and Avtar Singh, PHI, 1991.

Reference Books:

Assembly Language Programming the IBM PC by Alan R. Miller, Sybex INC, 1987.

ECE 416 DIGITAL COMMUNICATION LABORATORY

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	*Tutorial*	*Lab*				
2	-	-	3	3	50	50	100

COURSE OBJECTIVES

1. The main objective of this lab course is to gain the practical hands on experience by exposing the students to various digital modulation technique generation and demodulation.
2. Analyze the circuits of natural sampler, time division multiplexing and demultiplexing.
3. To provide hands-on sessions to use software tools like Matlab .

COURSE OUTCOMES

C406.1	At the end of the course the student will be able to analyze and verify sampling theorem
C406.2	At the end of the course the student will be able to generate of pulse analog and pulse digital modulated signals
C406.3	At the end of the course the student will be able to generate of FSK,PSK waveforms .
C406.4	At the end of the course the student will be able to generate digital modulated signals and TDM signals using Matlab

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															
	3															
	4															
	5															

List of experiments

1. Sample the given input signal for different sampling rates and recover the signal by means of appropriate low – pass filter.

2. Study the Pulse – Width Modulation for both AC and DC Modulating Signals and obtain the corresponding waveforms.

3. Study the Pulse – Position Modulation for both AC and DC Modulating Signals and obtain the corresponding waveforms.

4. Study the functioning of a given Analog to Digital Converter. Skill development/ Employability
5. Study the functioning of a given Digital to Analog Converter. Skill development/ Employability
6. Encode the given 4-Bit Data Word into 16-Bit Orthogonal Encoded Word using Hadamard Code.
7. Decode the 16-Bit Orthogonal Encoded Word to 4-Bit Data Word.
8. Study the performance of the given Continuously Variable Slope Delta Modulation (CVSD).
9. Obtain the characteristics of the Phase Shift Keying (PSK) Modulator.
10. Obtain the characteristics of the Frequency Shift Keying (FSK) Modulator.

ECE 417 DIGITAL SIGNAL PROCESSING LABORATORY

Credits	*Periods*			*Exam Hrs.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
2	-	-	3	3	50	50	100

COURSE OBJECTIVES

1. This course will introduce the basic concepts and techniques for processing signals on a computer.
2. The most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.
3. The course emphasizes intuitive understanding and practical implementations of the theoretical concepts.

COURSE OUTCOMES

By the end of the course student will be able to	
1.	Apply fundamental concepts related to switching theory using VHDL.
2.	Design the sequential and combinational circuits using VHDL
3.	Apply fundamental concepts of Signal processing using MATLAB.
4.	Analyze and Observe Magnitude and phase characteristics (Frequency response Characteristics) of digital filter types like IIR-Butterworth, Chebyshev, Bilinear, Impulse invariant, FIR window-design using MATLAB.

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**	**3**	**2**	_	_	_	**2**	**-**	**-**	**2**		**3**	
	2	**-**	**2**	**2**	**3**	**2**	_	_	_	**2**	**-**	**-**	**2**		**3**	
	3	**-**	**2**	**2**	**3**	**2**	_	_	_	**2**	**-**	**-**	**2**		**3**	
	4	**-**	**2**	**2**	**3**	**2**	_	_	**-**	**2**	**-**	**-**	**2**		**3**	
	5	**-**	**2**	**2**	**3**	**2**	_	_	_	**2**	**-**	**-**	**2**		**3**	

Cycle – I: Signal Processing with MATLAB

1. Generation of Discrete-Time Sequences
2. Implementation of Discrete-Time Systems
3. Frequency Analysis of Discrete Time Sequences

4. Frequency Analysis of Discrete Time Systems
5. Infinite Impulse Response Filter Design
6. Finite Impulse Response Filter Design

Cycle – II: VHDL Experiments

1. Logic Gates
2. Full Adder
3. SR Latch and D Latch
4. 8 x 1 Multiplexer and Demultiplexer
5. Up/Down Counter, Universal Shift Register
6. Mealy & Moore Counters

B.E. 4th Year 2nd Semester (Credit Based Grading System) with effect from the admitted batch of 2006 - 2007

ECE 421 ENGINEERING ECONOMICS AND MANAGEMENT

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES

1. The objective of this course is to provide the students with the management skills to enable them to assess investment and project management decisions. To demonstrate the sources of costs and explain how these affect price decisions.
2. To identify sources of risk and discuss ways to manage risk.
3. To understand private and public sources of finance for investment projects and the distinctions between criteria for private investment and public investment

COURSE OUTCOMES

C409.1	Able to comprehend macro and micro economics, law of demand, elasticity of demand, and utility.
C409.2	Able to explain the features, advantages and disadvantages of different market structures and types of business organizations.
C409.3	Able to comprehend managerial concepts like functions and principles of management, scientific and administrative management, and basic functions of human resource management.
C409.4	Able to explain how to plan and control production, how to select suitable location for a plant and break - even analysis.

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															
	3															
	4															
	5															

C409.5	Able to explain how to manage capital, functions of marketing and entrepreneurship.

1. Fundamentals of Economics – Scarcity and Efficiency Market, Command and Mixed Economics.
   Basic Elements of Supply and Demand – Law of Demand – Elasticity of Demand.
2. Business Organizations – Individual Proprietorship – Partnership – The Corporation.
   Statement of Profit and Loss – The Balance Sheet – Break-Even Analysis – Cost Concepts – Elements of Costs.
3. Principles and Functions of Management – Evolution of Management Thought – Decision Making Process.
   Organization Theory and Process – Leadership – Motivation – Communication – Conflict Management in Organization.
4. Plant Location – Plant Layout – Production Planning and Control – Product Design and Development – Channels of Distribution. Materials Management – Inventory Control.
5. Industrial Disputes and their Settlement – Provision of Factories Act and Industrial Disputes Act.
   Recent Trends in Contemporary Business Environment.

References:

1. Economics – Paul A. Samuelson and William D. Nordhaus.
2. Engineering Economics – Vol. 1 – Tara Chand.
3. Financial Management – S. N. Maheswari.
4. Essentials of Management – Koontz and O' Donnel.
5. Production and Operation Management – B. S. Goel.
6. Modern Production / Operation Management – Elwood S. Buffa, Rakesh K. Sarin.
7. Industrial Law - S. P. Jain.
8. Industrial Law - R. P. Maheswari and S. N. Maheswari.
9. Labour and Industrial Laws – Singh, Agarwal and Goel.

ECE 422 RADAR ENGINEERING AND NAVIGATIONAL AIDS

Credits	*Periods*			*Exam Hrs.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES

1. Define and Describe working principles of different types of radars,
2. Describe and Analyze Radar Range equation, Doppler Effect.
3. Apply and analyze tracking radars and special Radars (SAR, MST, Phased Array)
4. Recognize and significance of counter measures, mixers, protectors, displays and design aspects of radar receiver
5. Describe significance of radars for navigational aids
6. Provide strong fundamental knowledge to pursue their higher education in Radar engineering.

COURSE OUTCOMES

By the end of the course student will be able to	
1.	Solve problems related to principle of operation of basic Radar, Pulsed Radar & MTI Radar and Range equation and Doppler.
2.	Analyze principle of operation, applications of tracking radar, special Radars (SAR, Phased Array & MST).
3.	Analyze different types of Radars, Mixers & Protectors, displays, Tracking Radars, Counter Measures.
4.	Analyze Radars Applications for Navigational Aids.

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**		**2**
	2	**3**	**2**		**1**							**2**	**2**	**3**		**2**
	3	**3**	**2**		**1**							**1**	**2**	**3**		**2**
	4	**3**	**2**		**1**							**1**	**2**	**3**		**1**

1. Radar Equation, Radar Block Diagram and Operation, Prediction of Range, Minimum Detectable Signal, Receiver Noise, Probability Density Functions, S/N, Integration of Radar Pulses, Radar Cross-section, Transmitter Power, PRF and Range Ambiguities, Radar Antenna Parameters, System Losses and Propagation Effects.

   Employability

2. MTI and Pulse Doppler Radar: Introduction, Delay line Cancellers, Moving target Detector, Limitation to MTI performance, MTI from moving platform, Pulse Doppler Radar
3. Tracking Radar, Sequential Lobing, Conical Scan, Monopulse tracking Radar, Low

Employability

angle tracking, Pulse compression,

Block Diagrams of Synthetic Aperture Radar (SAR), Phased array Radars,. MST Radar, ECM, ECCM

Employability

4. Radar Receiver, Mixers, Radar Displays, Receiver Protectors.
5. Principles of Direction Finders, Aircraft Homing and ILS, Radio Altimeter, LORAN, DECCA, OMEGA, Inland Shipping Aids.

Employability

Text Book:

1. "Microwave and Radar Engineering" by Gottapu Sasi Bhushana Rao, ISBN – 978813179944 Pearson Education Chennai 2013.
2. Radar Engineering and Fundamentals of Navigational Aids, G S N Raju, IK International Publishers, 2008

References

1. Introduction to Radar Systems, Skolnik, McGraw Hill, 2007.

ECE 423 DATA COMMUNICATIONS

Credits	*Periods*			*Exam Hrs.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES

The objective is to provide the concepts of various data transmission modes, transmission mediums used for communications, Introduction to LANS, Data link layers and Network layers.

COURSE OUTCOMES

By the end of the course student will be able to	
1.	Understand the concept and basic terminology of Data Communication System.
2.	Understand and explain concepts of Transmission media and telephone networks.
3.	Identify and correct different errors occurred during data transmission.
4.	Enumerate the layers of the OSI model, TCP/IP and Explain the function(s) of each layer.
5.	Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

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**	**-**	**-**	**_**	**_**	**_**	**_**	**-**	**-**	**1**	**-**	**2**	**3**
	2	**3**	**3**	**3**	**-**	**-**	**_**	**_**	**_**	**_**	**-**	**-**	**1**	**-**	**2**	**3**
	3	**3**	**3**	**2**	**-**	**-**	**_**	**_**	**_**	**_**	**-**	**-**	**1**	**-**	**2**	**3**
	4	**3**	**3**	**2**	**-**	**-**	**_**	**_**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**3**
	5	**3**	**3**	**2**	**-**	**-**	**_**	**_**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**3**

Data Communication Concepts and Terminology:

Data Representation, Data Transmission, Modes of Data Transmission, Signal Encoding, Frequency Spectrum, Transmission Channel, Data Communication

Transmission Media:

Transmission Line Characteristics, Transmission Line Characteristics in Time Domain, Cross talk, Metallic Transmission Media, Optical Fiber Base-band Transmission of Data Signals, Telephone Network, Long Distance Network

Employability

Modems and Data Multiplexers:

Digital Modulation Methods, Multilevel Modulation, Differential PSK, Standard Modems, Limited Distance Modems and Line Drivers, Group Band Modems, Data Multiplexers, Statistical Time Division Multiplexers

Employability

Error Control:

Transmission Errors, Coding for Error Detection and Correction, Error Detection Methods, Forward Error Correction Methods, Reverse Error Correction

The Physical Layer, The Data Link Layer:

Need for Data Link Control, The Data Link Layer 196, Frame Design Considerations, Flow Control, Data Link Error Control, Data Link Management, HDLC-HIGH-LEVEL DATA LINK CONTROL

The Network Layer:

The Sub network Connections, Circuit Switched Sub networks, Store and Forward Data Sub networks, Routing of Data Packets, Internetworking, Purpose of the Network Layer, Title of X.25 Interface, Location of X.25 Interface, Addressing in X.25, Packet Assembler and Disassembler (PAD), Asynchronous Character Mode Terminal PAD

Employability

Local Area Networks:

LAN Topologies, Media Access Control and Routing, MIEDIA ACCESS CONTROL IN LOCAL AREA NETWORKS, INTERNETWORKING, THE TRANSPORT AND UPPER OSI Layer, The Session Layer, The Presentation Layer, The Application Layer.

Employability

Text Book:

Praksh C. Gupta 'DATA COMMUNICATIONS' Prentice Hall of India 1996.

ECE 423-2 BIOMEDICAL SIGNAL PROCESSING

Unit I

Signal processing: Review of Discrete time signals and systems - LTI systems - Response of LTI systems – Convolution - Difference equation representation of discrete systems Z transform - Transform analysis of LTI system – DFT. STFT

Unit II

Introduction to wavelets - CWT and DWT with Haar wavelet. Introduction to biosignals: Computers in medicine. Human anatomy and physiology - Cell structure - Origin of bioelectric potentials - Biomedical signals - The Brain and its potentials. Electrophysiological origin of brain waves. EEG signal and its characteristic- ECG signal origin and characteristics.

Unit III

Neurological signal processing: EEG analysis - Parametric modelling - Linear prediction theory; Autoregressive (AR) method; Recursive estimation of AR parameters. Cardiological signal processing: ECG parameters and their estimation - Arrhythmia analysis monitoring - ECG data reduction techniques

Unit IV

Digital filters - IIR and FIR - Notch filters - Optimal and adaptive filters. Weiner filters - steepest descent algorithm - LMS adaptive algorithm

Unit V

Adaptive interference / Noise cancellation: Types of noise in biosignals; Adaptive noise canceller - cancellation of 50 Hz signal in ECG - Cancellation of maternal ECG in foetal electrocardiography.

TEXTBOOKS

1. D. C Reddy, “Biomedical Signal Processing, Principles and Techniques”, Tata McGraw Hill Publishing Company Limited, First Edition, 2005
2. Willis J Tompkins, “Biomedical Digital Signal Processing”, Prentice Hall India Private Limited, First Edition, 2006.

TEXTBOOKS

1. Rangaraj M Rangayyan “Biomedical Signal Analysis – A case study approach” IEEE press series in biomedical engineering, First Edition, 2002.
2. John G Proakis, Dimitris and G. Manolakis, “Digital Signal Processing Principles algorithms, applications” PHI Third Edition. 2006

ECE 423-3 MICROWAE NETWORKS

UNIT-I Microwave Circuits: One port junction, Terminal voltages and currents in multi port junctions, Poynting's energy theorem, Normalized waves and scattering matrix, Properties of [S] matrix, Wave amplitude transmission matrix [A], Impedance matching techniques: Quarter-wave and Tapered line Impedance transformers, Two Port Networks analysis with Transmission matrices, S-Parameter and signal flow graphs

UNIT-II Microwave Waveguide Components: Microwave junctions, Bends, Scattering matrix E and H plane tee junctions, Magic-T , Applications of Magic-T, Microwave propagation in ferrites, Principles of Faraday rotation, Gyrator, Isolator and Circulator,

UNIT-III Waveguide Components: Mode transducers, Waveguide discontinuities, Terminations, Attenuators and Phase shifters, Rotary joints, Mechanical and gas type switches.

UNIT-IV Microwave Passive Components: Wave meters, Attenuators, Directional coupler, Scattering matrix of directional couplers, Coaxial and Strip line components : Terminations, Connectors and Transitions, Attenuators and phase shifters, Transmission line discontinuations, DC Returns and blocks, Low pas filters, MICS.

UNIT-V Microwave Resonators and Filters : Review of resonant circuits, Principles of microwave resonators, Field analysis of cavity resonators, Narrow band microwave filters, Wideband microwave filters, Some applications, Introduction to YIG filter, Scattering matrix of two-port gyrator networks.

Text Books:

1. "Microwave and Radar Engineering" by Gottapu Sasi Bhushana Rao, ISBN – 978813179944 Pearson Education Chennai 2013.
2. Microwave Engineering, G.S.N. Raju, IK International Publishers,

References:

1. Foundations For Microwave Engineering, R. R. Collin, McGraw Hill.
2. Microwave Communications – Components and Circuits, E. Hund, McGraw Hill.
3. Microwave Devices and Circuits, S. Y. Liao, PHI.

ECE 424 FIBER-OPTIC COMMUNICATIONS

Credits	*Periods*			*Exam Hrs.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES

1. To illustrate the basic optical laws, definitions and fiber structures.
2. To describe the signal degradation in optical fibers: Attenuation and dispersion.
3. To explain how the LED's, LASER's works as optical sources and pin photo detectors, avalanche photodiodes as optical detectors.
4. To describe the power launching and coupling to optical fibers through cables and connectors.
5. To illustrate optical link design methods.

COURSE OUTCOMES

By the end of the course student will be able to	
1.	Understand the propagation of optical signal in step and graded index optical fibers and Signal degradation in fibers.
2.	Explain the operation of various components associated with optical fibers & their application in WDM system.
3.	Understand the characteristics of LASERs and LEDs & photo detectors & their application in Fiber optic system.
4.	Apply the knowledge of Transmitter & Receiver in the design of Optical Fiber Link.
5.	Design of analog & Digital fiber optic link and understands the concepts of WDM.

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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**
	2	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**1**
	3	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**
	4	**1**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**1**	**1**
	5	**1**	**1**	**2**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**1**

1. Propagation: in Fibers:
   Elementary discussion of propagation in
   fibers Attenuation in Optical Fibers
   E M wave propagation in step-Index Fibers

E M wave propagation in graded-Index Fibers.

2. Optical Fibers and Associated

   Components: Fiber Properties

   Splices, connectors, Couplers, and Gratings.

Employabilty

3. Transmitting and Receiving Devices:

   Injection laser Characteristics

   LED structures, Characteristics and modulation

4. Optical Transmitters, Receivers and Fiber-optic Link Design:

5. Concepts of Fiber-Optic Networks and wavelength – Division Multiplexing:

Employability

Books:

For syllabus items 2,4 and 5

An Introduction to Fiber Optic Systems by John Powers, 2nd Edition, Irwin, 1997.

For syllabus item 1

Optical Communication Systems by John Gowar, PHI

1994 For syllabus item 3

Optical Fiber Communications, Principles and Practice by John M. Senior, Second Edition, PHI 1996.

ECE 426 MICROWAVE ENGINEERING AND ANTENNAS LABORATORY

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
2	-	-	4	-	50	50	100

COURSE OBJECTIVES

1. Characteristics of Reflex Klystron.
2. Study of power distribution in Directional coupler, E & H plane and Magic tee.
3. Wavelength and Frequency measurement.
4. Impedance measurement by slotted line method.
5. Gain and radiation pattern of Horn antenna.

COURSE OUTCOMES

C414.1	An ability to find the bench set up before start of the experiment. Identifying the required apparatus and procedure of doing the experiment.
C414.2	Ability to measure frequency, wave length of Microwave signal, VSWR and impedance of unknown load and characteristics of MW sources using bench set up
C414.3	An ability to plot the radiation pattern of horn antenna and other antennas using antenna trainer system
C414.4	Ability to measure and record the experimental data, plot it and analyze the results, and prepare a formal laboratory report.

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															
	3															
	4															
	5															

List of experiments

1) Measurement of VSWR
2) V-I Characteristics of GUNN Diod Employability
3) Measurement of Coupling Factor and Directivity of a 4-Port directional coupler
Skill Development
4) Measurement of Microwave frequency
5) Reflex Klystron Characteristics Employability
6) Radiation Pattern of Horn Antenna
7) Fiber Optic Analog Link
8) Fiber Optic Digital Link Skill Development

Other four experiments from the choice either from Microwave Engineering or from Antenna Theory

ECE 427 PROJECT – II

Credits	*Periods*			*Exam Hrs.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
8	-	-	12	-	50	50	100

COURSE OBJECTIVES

1. To inculcate leadership qualities in students and enable them to work in groups to complete the given project within a stipulated period.
2. To understand the impact of professional engineering solutions in societal and environmental contexts.
3. To prepare them to present their work in front of panel in a way developing their soft skills and ability to face the examiners.
4. To prepare graduates who will achieve peer-recognition; as an individual or in a team; through demonstration of good analytical, design and implementation skills.
5. To prepare graduates to recognize the need for and engage in life-long learning process.
6. To produce graduates as responsible citizens equipped with best human values and technological excellence.

COURSE OUTCOMES

C415.1	Upon completion of the course the students will be familiar with Identification of real world problems
C415.2	Upon completion of the course the students will be familiar with Awareness of design methodologies & its implementation
C415.3	Upon completion of the course the students will be familiar with Advanced programming techniques
C415.4	Upon completion of the course the students will be familiar with Technical report writing

APPLIED PHYSICS
(for EEE, ECE & Mech)

518

EEE 124 **Credits:3**
Instruction : 3 Periods & 1 Tut/Week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks: 60

Course Objectives:

- To enhance student's knowledge of theoretical and modern technological aspects in physics and to introduce fundamentals of physics relevant to engineering applications
- To introduce advances in technology for engineering applications

Course Outcomes:

By end of the course, student will be able to:	
1	Understand the properties of magnetic materials and superconductivity.
2	Understand the dielectric nature of materials, properties and its applications.
3	Aware about nano material properties, synthesis and characterization tools.
4	Familiar with fundamentals of crystal structures.
5	Learn the basic phenomenon involved in semiconductors and semiconductor devices.

SYLLABUS

UNIT I 12 Periods

Magnetic materials: Definition of magnetic permeability, magnetization and magnetic susceptibility, origin of magnetic moment, classification of magnetic materials, properties of diamagnetic and paramagnetic materials, ferromagnetic materials - hysteresis curve , domain theory of ferromagnetism, soft and hard ferromagnetic materials, anti-ferromagnetic and ferrimagnetic materials , ferrites and its applications

Superconductivity: Introduction, properties of superconductors, effect of temperature and magnetic field, Meissner effect, flux quantization , type – I and type – II superconductors high temperature superconductors, applications of superconductors, BCS theory (qualitative)

UNIT II 10 Periods

Dielectric materials: Definition of electric dipole moment, dielectric polarization and dielectric constant, types of polarization – electronic, ionic and oriental polarization, expression for polarisability, internal fields in solids, Classius – Mossotti equation, frequency dependence of electronic polarization ,properties of ferroelectric materials and their applications

UNIT III 10 Periods

Nanophase materials: Introduction to nanophase materials, properties of nanophase materials, synthesis of nanophase materials – chemical vapour deposition, sol-gel method, MEChanical attrition method, applications of nanophase materials. Principles of X-Ray florescence X-Ray Diffraction- Electron Microscopy (SEM and TEM)

UNIT IV 10 Periods

Crystal structure: Introduction, fundamental terms of crystallography – space lattice, , crystal lattice, unit cell, planes, seven crystal systems – Bravias lattices, cubic lattices, crystal directions and planes, Miller indices, interplanar spacing and interatomic distance , some simple crystal structures, body-centered cubic crystals, face-centered cubic crystals

UNIT V 12 Periods

Semiconductor Physics: Intrinsic and extrinsic semiconductors, Fermi level, carrier concentration in intrinsic semiconductor, continuity equation, direct and indirect band gap semiconductors. Lorentz force, Hall effect and its applications. Physics of semiconductor devices: open circuited p-n junction diode, energy diagram of p-n diode, working of a diode, volt-ampere characteristics of p-n junction, diode as a rectifier, light emitting diode (LED) , liquid crystal display (LCD), photodiode

TEXTBOOKS:

1. S.L Gupta and SanjeevGupta*Engineering physics*DhanpatRai publications.
2. M.N. Avadhanulu&P.G.Kshirasagar*A text book of engineering physics*, S.Chand publication

REFERENCE BOOKS:

1) V.Rajendran*Engineering physics* Tata McGraw Hill Education Private Limited
2) DattuRamanlal Joshi *Engineering Physics* Tata McGraw Hill Education Private Limited
3) A.Marikani*Engineering Physics* PHI Learning Private Limited

FUNDAMENTALS OF EEE

EEE 125 | **Credits:3**

Instruction: 3 Periods & 1 Tut/Week | Sessional Marks : 40

End Exam : 3 Hours | End Exam Marks : 60

Course Objectives:

- ➢ To analyze circuits by using basic network theorems and reduction techniques.
- ➢ To understand operation of various basic electronic components.
- ➢ To understand the principle of operation of electrical machines.

Course Outcomes:

By end of the course, student will be able to:	
1.	Apply KVL, KCL, Source Transformation, Mesh and Nodal Analysis.
2.	Find Energy and Power Equations of a given circuit.
3.	Apply network reduction techniques.
4.	Operate different types of electronic components like diode, transistor, FET, MOSFET.
5.	Use the basic concepts of Magnetic Circuits and Electro Mechanical Energy conversion.

SYLLABUS

UNIT I — 14 Periods

The Fundamental Laws of Electrical Engineering: Units, Electric Current, Coulomb's law, Ohm's Law, Kirchhoff's laws, Ampere's Law Faraday's Law of Electromagnetic Induction, Lenz's Law.

skill Development

Circuit Elements: Current and Voltage Sources, Source transformation, Reference Directions and Symbols, Resistance, Inductance and Capacitance Parameters, Series and parallel Combinations of Resistance, Inductance and Capacitance, Energy and Power, Network Reduction by Delta-Star transformation.

UNIT II — 12 Periods

Elementary Network Theory: Mesh Analysis and Nodal Analysis, Superposition Theorem, Thevenin's and Norton's Theorems, Maximum Power Transfer Theorem, Tellegen's Theorems for DC Circuits. AC Circuits – Definitions of Average and Effective Values of Periodic Functions, Instantaneous Complex, Real and Reactive Powers, Power Factor, Phasor diagrams of 1-ph R, RL, RC, RLC Circuits.

Skill Development

UNIT III 12 Periods

Magnetic Theory and Circuits: The Magnetic Circuit: Concept and Analogies, Units, Magnetic Circuit Computations, Hysteresis and Eddy-Current Losses in Ferromagnetic Materials.

Skill Development

UNIT IV 12 Periods

Electronic Devices: The Boltzmann Relation and Diffusion Current in Semiconductors, The Semiconductor Diode, The Transistor, The Junction Field-Effect Transistor (JFET), The Insulated-Gate FET (or MOSFET), the Silicon-Controlled Rectifier (SCR).

Skill Development

UNIT V 10 Periods

Electromechanical Energy Conversion: Analysis of Induced Voltages, Analysis of Electromagnetic Torque, Constructional Features of Electric Machines, (Elementary Treatment only).

TEXT BOOK:

1. Vincent Del Toro, "Electrical Engineering Fundamentals", PHI publications.

REFERENCE BOOKS:

1. Jimmie J. Cathey and Syed A. Nasar "Basic Electrical Engineering", McGraw-Hill publications.
2. M.E. VanValkenburg, "Network Analysis", PHI publications.
3. V K Mehta, "Principles of Electrical Engineering" S. Chand & Co.

OBJECT ORIENTED PROGRAMMING WITH C++LAB

(Common for all branches, except for Civil & Chemical branches)

EEE 128 **Credits :3**

Instruction : 2 Periods/Week Practicals : 3 Periods/week Sessional Marks : 50

End Exam : 3Hrs End Exam Marks : 50

Course Objectives:

- To introduce Object Oriented Programming (OOP) using the C++ Language.
- To provide the basic concepts and techniques which form the Object Oriented Programming paradigm.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Understand how to use the programming constructs of CPP.
2.	Use Object Oriented Programming concepts to develop object oriented programs.
3.	Apply various object oriented features to solve real world computing problemsusing C++ language.

SYLLABUS

List of the experiments to be done on the following topics

1. Overview (Transition from C)
2. OOP Concepts and Characteristics
3. Preprocessor , Command line arguments
4. Classes & Data Abstraction
5. Objects
6. Operator Overloading
7. Inheritance
8. Virtual Functions & Polymorphism
9. I/O Streams
10. Templates
11. File Processing
12. Exception Handling Concepts

REFERENCE BOOKS:

1. Mahesh Bhave, Sunil patekar*Object Oriented Programming in C++* Second edition, Pearson
2. R Rajaram, *Object Oriented Programming in C++* 2nd Edition New Age International Publishers

3. Herbert Schildt*C++ the Complete Reference* III edition, TMH 1999
4. E Balaguruswamy*Object Oriented Programming with C++*3rd Edition , McGraw Hill

LIST OF SAMPLE PROGRAMS

1. Write a C++ program that uses a recursive function for solving Towers of Hanoi problem.
2. Write a C++ program to find both the largest and smallest number in a list of integers.
3. Write a C++ program that uses function templates to solve problems 1 and 2 experiments
4. Write a C++ program to implement the matrix ADT using a class. Use operator overloading for implementation
5. Write the definition for a class called **Rectangle** that has floating point data members length and width. The class has the following member functions: **void setlength(float)** to set the length data member **void setwidth(float)** to set the width data member **float perimeter()** to calculate and return the perimeter of the rectangle **float area()** to calculate and return the area of the rectangle **void show()** to display the length and width of the rectangle **intsameArea(Rectangle)** that has one parameter of type Rectangle. sameArea returns 1 if the two Rectangles have the same area, and returns 0 if they don't.
   i. Write the definitions for each of the above member functions.
   ii. Write main function to create two rectangle objects. Set the length and width of the first rectangle to 5 and 2.5. Set the length and width of the second rectangle to 5 and 18.9. Display each rectangle and its area and perimeter.
   iii. Check whether the two Rectangles have the same area and print a message indicating the result. Set the length and width of the first rectangle to 15 and 6.3. Display each Rectangle and its area and perimeter again. Again, check whether the two Rectangles have the same area and print a message indicating the result
6. Create a class called MusicIns to contain three methods string(),wind() and perc(). Each of these methods should initilialize string array to contain the following
   i. Veena, guitear, sitar, sarod and mandolin under string
   ii. Flute, clarinet, saxophone, nadaswaram and piccolo under wind
   iii. Table, mridangam, bangos, drums and tambour under perc

   It should also display the contents of the arrays initialized , create a sub class call TypeIns to contain a method called get() and show(). The get() methods must display a menu as follows

- o String instruments
- o Wind instruments
- o Percussion instruments

The show method should display the relevant details according to user choice the base class variable must be accessible only to its derived classes.

7. Create a base class called shape. It should contain two methods getCoord(), showCoord() to accept x and y co ordinates and to display the same respectively . Create a sub class called Rect. It should contain method to display length and breadth of the rectangle called showCoord() . In main method, execute the showCoord() of Rect class by applying the dynamic method dispatch concept

8. Create a class called car. Initialize the color and body attributes to “blue” and “wagon”. there should be two constructors one is a default the creates blue wagon the other constructor should take two argcolor, body and initialize. write method toString() that returns the color and body. Create a sub class funcar. In sub class there are two constructors to invoke super class constructors resp. Write a method playCD in sub class that displays the message “Beautiful music fills the passenger compartment” execute the methods to show the messages

   i. Mycar is a blue wagon

   ii. My father’s car is red convertible.

9. Create the ZooAnimal constructor function. The function has 4 parameters — a character string followed by three integer parameters. In the constructor function dynamically allocate the name field (20 characters), copy the character string parameter into the name field, and then assign the three integer parameters to cageNumber, weightDate, and weight respectively.

10. Write a C++ program to perform operations on complex numbers using operator overloading

11. Write a C++ program to write number 1 to 100 in a data file NOTES.TXT

12. Write a function in C++ to count and display the number of lines not starting with alphabet ‘A’ present in a text file “STORY.TXT”.
    Example:
    If the file “STORY.TXT” contains the following lines,
    The rose is red.
    A girl is playing there.
    There is a playground.
    An aeroplane is in the sky.
    Numbers are not allowed in the password.
    The function should display the output as 3

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.

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: **S**ource 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.

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Skill Development

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, 7th edition, Mc.graw hill publications 2006.
2. M. E. Vanvalkunberg, Network analysis, 3rd 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, 5th 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 γ 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.

DIGITAL LOGIC DESIGN

EEE 216 **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.

Skill Development

Skill Development

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).

Skill Development

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.

Skill Development

UNIT-III: SequentialLogicCircuits **5 Periods**

Sequential Circuits, Latches, Flip-Flops, Analysis of Clocked Sequential Circuits,Flip-Flop Conversions, Verilog HDL for SequentialCircuits.

Skill Development

RegistersandCounters **6Periods**

Registers, Shift Registers, Ripple Counters, Synchronous Counters, Johnson and Ring counters, Verilog HDL for Registers and Counters.

Skill Development

Skill Development

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.

Skill Development

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.

Skill Development

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.

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.
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.

Skill Development

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.
Instrument Transformers: CTs, PTs - Ratio and Phase angle errors and their reduction.

Skill Development

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.

UNIT-IV: **(12 periods)**

INTERFACING WITH ADVANCED Skill Development

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:

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.

Skill Development & Employability

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.

Skill Development & Employability

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, 4th Edition.
2. A.M. Tanenbaum -Data Structures Using C, pearson education,7th edition, 2008

Reference Books:

1. Trmbly & Sorenson An Introduction To Data Structures With Applications Tata Mgcrew Hill, 2nd 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

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

Employability

UNIT III: **[12 Periods]**

Skill Development

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

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

Employability

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.

Skill Development & Employability

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.

Skill Development & Employability

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:

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.

Skill Development

MICROPROCESSORS:
Using 8085:

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:

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

Employability

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

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

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, 8^{th} 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

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

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.

Skill Development

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, 4th Edition, 2012, Khanna Publishers.
2. M.D. Singh, K.B. Khanchandani – Power Electronics, 2nd edition, 2006,Tata Mcgraw –Hill Publishing Company Limited.

Reference Books:

1. Muhammad H Rashid – Power Electronics, Circuits, Devices & Applications,4th 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

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.

Employability

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

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

Skill Development & Employability

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.

ELECTIVE-1

EEE411 – 1 INSTUMENTATION

INSTRUCTION : 4 Periods per Week
UNIVERSITY EXAMINATION : 3 Hours
UNIVERSITY EXAMINATION MARKS : 70
SESSIONAL MARKS : 30

CREDITS : 4

INTRODUCTION TO INSTRUMENTATION: TYPICAL APPLICATIONS OF INSTRUMENT SYSTEM, FUNCTIONAL ELEMENTS OF MEASURING SYSTEM,CLASSIFICATION OF INSTRUMENTS, DEFINITIONS OF ACCURACY, PRECISION, FIDILITY, RESOLUTION, LINEARITY, DIGITAL COMPUTERS, STANDARDS AND CALIBRATION.

STATIC AND DYNAMIC CHARACTERISTICS OF INSTRUMENTS: INTRODUCTION, ERRORS AND UNCERTAINITIES IN PERFORMANCE PARAMETERS, PROPAGATION OF UNCERTAINITIES IN COMPOUND QUANTITIES, STATIC PERFORMANCE PARAMETERS, IMPEDANCE LOADING AND MATCHING, SPECIFICATION OF STATIC CHARACTERISTICS, SELECTION OF THE INSTRUMENT. FORMULATION OF THE SYSTEM DYNAMIC EQUATIONS, DYNAMIC RESPONSE COMPENSATION.

TRANSUDUCERS AND INTERMEDIATE ELEMENTS: INTRODUCTION, CLASSIFICATION OF ANALOG, DIGITAL, ACTIVE, PASSIVE, INTERMEDIATE ELEMENTS LIKE AMPLIFIERS COMPENSATORS, DIFFERENTIATING AND INTEGRATING ELEMENTS, FILTERS, A-D AND D-A CONVERTERS, DATA TRANSSIMISION ELEMENTS.

Skill Development

INDICATING AND RECORDING ELEMENTS: INTRODUCTION, DIGITAL VOLTMETERS, , CATHODE RAY OSCILLOSCOPES, GALVONOMETRIC RECORDS, SERVO TYPE POTENTIOMETRIC RECORDS, MAGNETIC TAPE RECORDING, DIGITAL RECORDER, MEMORY TYPE DATA ACQUISITION SYSTEMS, DATA DISPLAY AND STORAGE.

MEASUREMENT OF NON-ELECTRICAL QUANTITIES WITH ELECTRICAL TRANSDUCERS: VELOCITY, ACCELERATION, FORCE, TORQUE, PRESSURE, FLOW, TEMPERATURE AND ACCOUSTICS.

BIOMEDICAL MEASUREMENTS AND BIOMETRICS: INTRODUCTION, MEASUREMENT OF BLOOD PRESSURE AND BIO ELECTRIC POTENTIALS, ECG RECORDING, PHYSIOLOGICAL EFFECTS OF ELECTRIC CURRENT, SHOCK HAZARDS, METHODS OF ACCIDENT PREVENTION.

Skill Development & Employability

Skill Development & Employability

TEXT BOOK :

1. "INSTRUMENTATION, MEASUREMENT AND ANALYSIS" BY B. C. NAKRA AND K.K. CHAUDARY.

REFERENCE BOOKS :

1. "BIOMEDICAL INSTRUMENTATION AND MEASUREMENT" BY I. CROMWELL, F. J. WEIBALI, AND E.A.PFEIFFER.

2. "ELECTRICAL AND ELECTRONIC MEASUREMENTS AND INSTRUMENTATION" BY A. K. SAWHANEY

3. " ELECTRONIC INSTRUMENTATION" BY H.S. KALSI.

2015-16/288, 2016-17/290,2017-18/285.

ELECTIVE-1

EEE411-2 OPERATIONS RESEARCH

INSTRUCTION : 4 Periods per Week
UNIVERSITY EXAMINATION : 3 Hours
UNIVERSITY EXAMINATION MARKS : 70
SESSIONAL MARKS : 30

CREDITS : 4

INTRODUCTION TO OPTIMIZATION: ENGINEERING APPLICATIONS OF OPTIMIZATION, STATEMENT OF PROBLEM, CLASSIFICATION OF OPTIMIZATION PROBLEM TECHNIQUES.

LINEAR PROGRAMMING : INTRODUCTION, REQUIREMENTS FOR A LP PROBLEM, EXAMPLES ON THE APPLICATION OF LP, GRAPHICAL SOLUTION OF 2-VARIABLE LP PROBLEMS, SOME EXCEPTIONAL CASES, GENERAL MATHEMATICAL FORMULATION FOR LPP, CANONICAL AND STANDARD FORMS OF LP PROBLEM, SIMPLEX METHOD, EXAMPLES ON THE APPLICATION OF SIMPLEX TECHNIQUES.

ARTIFICIAL VARIABLE TECHNIQUE: BIG-M METHOD AND TWO PHASE TECHNIQUES.

Skill Development

TRANSPORTATION PROBLEM: MATRIX TERMINOLOGY, DEFINITION AND MATHEMATICAL REPRESENTATION OF TRANSPORTATION MODEL, FORMULATION AND SOLUTION OF TRANSPORTATION MODELS (BASIC FEASIBLE SOLUTION BY NORTH-WEST CORNER METHOD, INSPECTION METHOD. VOGELL'S APPROXIMATION METHOD)

Skill Development

ASSIGNMENT PROBLEM: MATRIX TERMINOLOGY, DEFINITION OF ASSIGNMENT MODEL, COMPARISON WITH TRASPORTATION MODEL, MATHEMATICAL REPRESENTATION OF ASSIGNMENT MODEL, FORMULATION AND SOLUTION OF ASSIGNMENT MODELS.

PERT NETWORK: INTRODUCTION, PHASES OF PROJECT SCHEDULING, NETWORK LOGIC, NUMBERING THE EVENTS (FULKERSON'S RULE), MEASURE OF ACTIVITY.

Skill Development

PERT NETWORK COMPUTATIONS: FORWARD PASS AND BACKWARD PASS COMPUTATIONS, SLACK CRITICAL PATH, PROBABILITY OF MEETING THE SCHEDULED DATES.

Employability

INVENTORY MODELS: INTRODUCTION, NECESSITY FOR MAINTAINING INVENTORY, CLASSIFICATION OF INVENTORY MODELS, INVENTORY MODELS WITH DETERMINISTIC DEMAND, DEMAND RATE UNIFORM-PRODUCTION RATE INFINITE, DEMAND RATE NON-UNIFORM PRODUCTION RATE FINITE, DEMAND RATE UNIFORM-PRODUCTION RATE FINITE.

Employability

GAME THEORY: USEFUL TERMINOLOGY, RULES FOR GAME THEORY, SADDLE POINT, PURE STRATEGY, REDUCE GAME BY DOMINANCE, MIXED STRATEGIES, 2X2 GAMES WITHOUT SADDLE POINT.

Skill Development

TEXT BOOKS:

1. "OPERATIONS RESEARCH-AN INTRODUCTION' BY H.TAHA, PRENTICE HALL OF INDIA Pvt. Ltd.
2. "ENGINEERING OPTIMIZATION-THEORY & PRACTICE" BY S.S. RAO, NEW AGE INTERNATIONAL (P) Ltd.
3. "OPERATIONS RESEARCH – AN INTRODUCTION" BY P.K.GUPTA & D.S.HIRA, S.Chnd & Co. Ltd.

2015-16/286, 2016-17/288,2017-18/283 **ELECTIVE-1**

EEE411-3 DIGITAL SIGNAL PROCESSING

INSTRUCTION : **4 Periods per Week**
UNIVERSITY EXAMINATION : **3 Hours**
UNIVERSITY EXAMINATION MARKS : **70**
SESSIONAL MARKS : **30**
CREDITS : 4

1. **DISCRETE - TIME SIGNALS AND SYSTEMS:**
   DISCRETE - TIME SIGNALS – SEQUENCES, LINEAR SHIFT – INVARIANT SYSTEMS, STABILITY AND CASUALITY, LINEAR CONSTANTS – COEFFICIENT DIFFERENCE EQUATIONS, FREQUENCY DOMAIN REPRESENTATION OF DISCRETE – TIME SIGNALS AND SYSTEMS.
2. **APPLICATIONS OF Z – TRANSFORMS:**
   SYSTEM FUNCTIONS H(Z) OF DIGITAL SYSTEMS, STABILITY ANALYSIS, STRUCTURE AND REALIZATION OF DIGITAL FILTERS, FINITE WORD LENGTH EFFECTS.
3. **DISCRETE FOURIER TRANSFORM (DFT):**
   PROPERTIES OF THE DFS, DFS REPRESENTATION OF PERIODIC SEQUENCES, PROPERTIES OF DFT, CONVOLUTION OF SEQUENCES.
4. **FAST – FOURIER TRANSFORMS (FFT):**
   RADIX – 2 DECIMATION – IN – TIME (DIT) AND DECIMATION – IN – FREQUENCY (DIF), FFT ALGORITHMS, INVERSE FFT.
5. **IIR DIGITAL FILTER DESIGN TECHNIQUES:**
   DESIGN OF IIR FILTERS FROM ANALOG FILTERS, ANALOG FILTERS APPROXIMATIONS (BUTTERWORTH AND CHEBYSHEV APPROXIMATIONS), FREQUENCY TRANSFORMATIONS, GENERAL CONSIDERATIONS IN DIGITAL FILTER DESIGN, BILINEAR TRANSFORMATION METHOD, STEP AND IMPULSE INVARIANCE TECHNIQUE.
6. **DESIGN OF IIR FILTERS:**
   FOURIER SERIES METHOD, WINDOW FUNCTION TECHNIQUES, COMPARISON OF IIR AND FIR FILTERS.
7. **APPLICATIONS:**
   APPLICATIONS OF FFT IN SPECTRUM ANALYSIS AND FILTERING, APPLICATION OF DSP IN SPEECH PROCESSING.

TEXT BOOKS:

ALAN V. OPPENHEIM & RONALD W. SCHAFER: DIGITAL SIGNAL PROCESSING, PHI.

REFERENCES:

1. SANJIT K. MITRA, DIGITAL SIGNAL PROCESSING “A – COMPUTER BASED APPROACH”, TATA MC GRAW HILL.
2. RADDAE & RABINER, APPLICATION OF DIGITAL SIGNAL PROCESSING.
3. S. P. EUGENE XAVIER, SIGNALS, SYSTEMS AND SIGNAL PROCESSING, S. CHAND & CO. LTD.
4. ANTONIO, ANALYSIS AND DESIGN OF DIGITAL FILTERS, TATA MC GRAW HILL.

EEE412 POWER SYSTEM ANALYSIS & STABILITY

INSTRUCTION	**: 4 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 70**
SESSIONAL MARKS	**: 30**
CREDITS : 4	

P.U. REPRESENTATION: SINGLE LINE DIAGRAM, PER UNIT QUANTITIES, P.U. IMPEDANCE OF 3-WINDING TRANSFORMERS, P.U. IMPEDANCE DIAGRAM OF A POWER SYSTEM.

LOAD FLOW STUDIES: FORMULATION OF NETWORK MATRICES, LOAD FLOW PROBLEM, GAUSS-SEIDEL METHOD, NEWTON-RAPHSON METHOD & FAST DECOUPLED METHOD OF SOLVING LOAD FLOW PROBLEM.

Skill Development

SYMMETRICAL FAULT ANALYSIS: 3-PHASE SHORT CIRCUIT CURRENTS AND REACTANCES OF A SYNCHRONOUS MACHINE, FAULT LIMITING REACTORS.

SYMMETRICAL COMPONENTS: THE SYMMETRICAL COMPONENTS, PHASE SHIFT IN DELTA/STAR TRANSFORMERS, 3-PHASE POWER INTERMS OF SYMMETRICAL COMPONENTS.

UN-SYMMETRICAL FAULTS: VARIOUS TYPES OF FAULTS – LG, LL, LLG ON AN UNLOADED ALTERNATOR, SEQUENCE IMPEDANCES AND SEQUENCE NETWORKS.

Skill Development

POWER SYSTEM STABILITY: CONCEPTS OF STABILITY (STEADY STATE AND TRANSIENT), SWING EQUATION, EQUAL AREA CRITERION, CRITICAL CLEARING ANGLE AND TIME FOR TRANSIENT STABILITY, STEP BY STEP METHOD OF SOLUTION, FACTORS AFFECTING TRANSIENT STABILITY.

Skill Development

TEXT BOOKS:

1. POWER SYSTEM ANALYSIS BY HADI SADAT, Mc Graw Hill, 1999.
2. ELEMENTS OF POWER SYSTEM ANALYSIS, WILLIAM D. STEVENSON, Jr, Mc Graw Hill Pub.
3. POWER SYSTEM ENGINEERING BY J.G. NAGARATH & D.P. KOTHARI, TMH Pub.

EEE 413- ELECTRIC DRIVES AND TRACTION

INSTRUCTION : **4 Periods per Week**
UNIVERSITY EXAMINATION : **3 Hours**
UNIVERSITY EXAMINATION MARKS : **70**
SESSIONAL MARKS : **30**
CREDITS : 4

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.

Skill Development

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

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

Skill Development

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

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-WHEE, CALCULATIONS, ENVIRONMENTAL FACTORS.
GENERAL FACTORY DRIVE, PAPER MILL DRIVE, STEEL MILL DRIVE, COAL MINING DRIVE.

ELECTRICAL TRACTION: GENAL FEATURES AND SYSTEMS OF TRAC ELECTRIFICATION, TRACTION MOTORS, LOCO WHEEL ARRANGEMENT AND RIDING QUALITIES, TRANSMISSION OF DRIVE, TRACTION MOTOR CONTROL (SERIES-PARALLEL CONTROL), TRAC EQUIPMENT AND COLLECTION GEAR, TRAIN MOVEMENT, SPEED-TIME CURVE AND SPEED DISTANCE CURVE, SPECIFIC ENERGY CONSUMPTION (SEC) AND FACTORS AFFECTING IT.

Employability

Skill Development

TEXT BOOKS:

1. " A FIRST COURSE ON ELECTRIC DRIVES " BY S. K. PILLAI, WILEY ESASTREN LTD.
2. " UTILISATION OF ELECTRICAL ENERGY " (S.I. UNITS) BY E. OPEN SHAW TAYLOR AND V.V.L. RAO ORIENTLONG MAN.

REFERENCE BOOK:

1. " MODERN ELECTRIC TRACTION " BY H. PARTAB. DHANPAT ROY & Co.
2. " ELECTRIC DRIVES" BY VEDAM SUBRAMANYAM, TMH Pub.

2015-16/291, 2016-17/293,2017-18/288.

EEE414 POWER SYSTEM PROTECTION

INSTRUCTION	**: 4 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 70**
SESSIONAL MARKS	**: 30**
CREDITS	**: 4**

FUSES: TYPES, HIGH VOLTAGE HRC FUSES, APPLICATIONS, SELECTION. FAULT CLEARING AND CIRCUIT BREAKERS, TRANSIENT RECOVERY VOLTAGE, SINGLE & DOUBLE FREQUENCY TRANSIENTS, RESISTANCE SWITCHING, CURRENT CHOPPING, SWITCHING OF CAPACITOR BANKS AND UN-LOADED LINES, RATINGS AND CHARACTERISTICS OF CIRCUIT BREAKERS, FORMATION OF ARC, METHODS OF ARC EXTINCTION.

CIRCUIT BREAKERS: CLASSIFICATION, PRINCIPLE OF OPERATION, CONSTRUCTIONAL FEATURES OF AIR CIRCUIT BREAKERS, OIL CIRCUIT BREAKERS, AIR BLAST CIRCUIT BREAKERS, SF-6 CIRCUIT BREAKERS AND VACCUM CIRCUIT BREAKERS, TESTING OF CIRCUIT BREAKERS.

Employability

RELAYING: DIFFERENT TYPES, PRINCIPLE OF OPERATION AND CHARACTERSTICS, OVER CURRENT, EARTH FAULT, DIFFERENTIAL AND DISTANCE PROTECTION WITH SIMPLE APPLICATIONS TO ALTERNATORS, TRANSFORMERS, SINGLE AND PARALLEL FEEDERS. INTRODUCTION TO SOLID STATE RELAYING, STATIC RELAYS FOR TIME LAG OVER CURRENT AND DIFFERENTIAL PROTECTION.

Employability

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 ETC., INSULATION CO-ORDINATION.

Skill Development

SUB-STATION LAYOUT & BUS BARS: SCHEMES OF LAYOUT AND BUS-BAR DESIGN.

Employability

TEXT BOOKS:

1. ELECTRICAL POWER SYSTEMS BY C.L. WADHWA
2. ELECTRICAL POWER BY S.L. UPPAL
3. POWER SYSTEM PROTECTION & SWITCH GEAR BY B. RAVINDRANATH & M. CHANDA, NEW AGE Pub., 1996

EEE415 DIGITAL CONTROL SYSTEMS

INSTRUCTION	**: 4 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 70**
SESSIONAL MARKS	**: 30**
CREDITS	**: 4**

Skill Development

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.

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

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

THE STATE VARIABLE TECHNIQUES: THE STATE VARIABLE TECHNIQUES, STATE EQUATION AND STATE TRANSITION EQUATIONS OF CONTINUOUS DATA SYSTEMS. STATE TRANSITION MATRIX SOLUTIONS, PROPERTIES OF STATE TRANSITION MATRIX, SOLUTION OF NON-HOMOGENEOUS STATE EQUATIONS, 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

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

2015-16/293, 2016-17/295,2017-18/290.

EEE 416 ADVANCED CONTROL SYSTEMS

INSTRUCTION	**: 4 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 70**
SESSIONAL MARKS	**: 30**
CREDITS	**: 4**

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 SYSTEMS.

Skill Development

STATE VARIABLE ANALYSIS: CONCEPT OF STATE VARIABLES & STATE MODELS, STATE MODEL FOR LINEAR CONTINUOUS TIME SYSTEMS, SOLUTION OF STATE EQUATION, STATE TRANSITION MATRIX, CONCEPT OF CONTROLLABILITY & OBSERVABILITY (SIMPLE PROBLEMS TO UNDERSTAND THEORY)

INTRODUCTION TO DESIGN: INTRODUCTION-PRELIMINARY CONSIDERATIONS OF CLASSICAL DESIGN-LEAD COMPENSATION-LAG COMPENSATION-REALIZATION OF COMPENSATING NETWORKS-CASCADE COMPENSATION IN TIME DOMAIN AND FREQUENCY DOMAIN (ROOT LOCUS AND BODE PLOT TECHNIQUES)- POLE PLACEMENT BY STATE FEED-BACK, STATE VARIABLES AND LINEAR DISCRETE-TIME SYSTEMS.

Skill Development

TEXT BOOKS:

1. CONTROL SYSTEMS COMPONENTS BY G.J. GIBSON & TUETOR
2. CONTROL SYSTEMS BY R.C. SUKLA, DHANPATHRAI PUBLICATIONS
3. AUTOMATIC CONTROL SYSTEMS BY B.C. KUO, PRENTICE HALL PUBLICATION

REFERENCE BOOK:

1. CONTROL SYSTEM PRINCIPLES & DESIGN BY M. GOPAL, TMH, 1998.

EEE 417 POWER ELECTRONICS LABORATORY

INSTRUCTION	**: 3 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 50**
SESSIONAL MARKS	**: 50**
CREDITS	**:2**

EEE 418 ELECTRICAL MACHINES LABORATORY–II

INSTRUCTION	**: 3 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 50**
SESSIONAL MARKS	**: 50**
CREDITS	**:2**

EEE 419 INDUSTRIAL TRAINING

2015-16/297, 2016-17/299,2017-18/294.

E421-ENGINEERING ECONOMICS & MANAGEMENT

INSTRUCTION	**: 4 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 70**
SESSIONAL MARKS	**: 30**
CREDITS	**: 4**

1. **FUNDAMENTALS OF ECONOMICS**- SCARCITY AND EFFICIENCY MARKET, COMMAND AND MIXED ECONOMICS. BASIC ELEMENTS OF SUPPLY AND DEMAND- LAW OF DEMAND- ELASTICITY OF DEMAND.

2. **BUSINESS ORGANIZATIONS**- INDIVIDUAL PROPRIETORSHIP- PARTNERSHIP- THE CORPORATION.

   STATEMENTS OF PROFIT AND LOSS- THE BALANCE SHEET- BREAK-EVEN ANALYSIS- COST CONCEPTS- ELEMENTS OF COSTS.

3. **PRINCIPLES AND FUNCTIONS OF MANAGEMENT**- EVOLUTION OF MANAGEMENT THOUGHT- DECISION MAKING PROCESS.
   ORGANIZATION THEORY AND PROCESS- LEADERSHIP- MOTIVATION- COMMUNICATION- CONFLICT MANAGEMENT IN ORGANIZATION.

4. **PLANT LOCATION**- PLANT LAYOUT- PRODUCTION PLANNING AND CONTROL- PRODUCT DESIGN AND DEVELOPMENT- CHANNELS OF DISTRIBUTION. MATERIALS MANAGEMENT- INVENTORY CONTROL.

5. **INDUSTRIAL DISPUTES AND THEIR SETTLEMENTS**- PROVISION OF FACTORIES ACT AND INDUSTRIAL DISPUTES ACT. RECENT TRENDS IN CONTEMPORARY BUSINESS ENVIRONMENT.

REFERENCES:

1. ECONOMICS- PAUL A. SAMUELSON AND WILLIAM D. NORDHAUS.
2. ENGINEERING ECONOMICS- VOL..1, TARA CHAND.
3. FINANCIAL MANAGEMENT- S.N. MAHESWARI.
4. ESSENTIALS OF MANAGEMENT- KOONTZ & O' DONNEL.
5. PRODUCTION & OPERATION MANAGEMENT- B.S. GOEL.
6. MODERN PRODUCTION/OPERATION MANAGEMENT- ELWOOD S. BUFFA, RAKESH K. SARIN.
7. INDUSTRIAL LAW- S.P. JAIN.
8. INDUSTRIAL LAW- R.P. MAHESWARI & S.N. MAHESWARI.
9. LABOUR & INDUSTRIAL LAWS- SINGH, AGARWAL & GOEL.

2015-16/298, 2016-17/300,2017-18/295.

EEE422 POWER SYSTEM OPERATION & CONTROL

INSTRUCTION	**: 4 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 70**
SESSIONAL MARKS	**: 30**
CREDITS	**: 4**

LOAD FLOW STUDIES:

REVIEW OF LOADFLOW MODELS, DECOUPLED LOADFLOW, FAST DECOUPLED LOADFLOW (FDLF), APPLICATION OF SPARSE TECHNIQUES TO LOAD FLOW MODELS.

OPTIMAL SYSTEM OPERATION:

OPTIMAL OPERATION OF GENERATORS OF A BUS BAR, OPTIMAL UNIT COMMITMENT, OPTIMAL GENERATION SCHEDULING, OPTIMAL LOADFLOW PROBLEM, OPTIMAL LOADFLOW SOLUTION, OPTIMAL SCHEDULING OF HYDRO-THERMAL SYSTEMS, POWER SYSTEM SECURITY

Employability

AUTOMATIC GENERATION & VOLTAGE CONTROL:

LOAD-FREQUENCY CONTROL, CONCEPTS, LOADFREQUENCY CONTROL OF A SINGLE AREA SYSTEM, LOADFREQUENCY CONTROL OF A TWO AREA SYSTEM, LOADFREQUENCY CONTROL AND ECONOMIC DISPATCH CONTROL, SPEED GOVERNOR DEAD-BAND AND ITS EFFECT ON AUTOMATIC GENERATION CONTROL

Skill Development

EMERGENCY CONTROL:

CONCEPTS, PREVENTIVE AND EMERGENCY CONTROL, COHERENT AREA DYNAMICS, STABILITY ENHANCEMENT METHODS, LONG TERM FREQUENCY DYNAMICS, AVERAGE SYSTEM FREQUENCY, CENTRE OF INERTIA.

Employability

TEXT BOOKS:

1.POWER SYSTEM ENGINEERING BY I.G. NAGARATH & D.P. KOTHARI (TMH PUBLICATIONS)
2.ELECTRIC ENERGY SYSTEMS THEORY-AN INTRODUCTION BY OLLE I. ELGERD (TMH EDITION)

REFERENCE BOOKS:

1. ADVANCED POWER SYSTEM ANALYSIS AND DYNAMICS BY L.P. SINGH , WILEY EASTERN LIMITED, THIRD EDITION
2. POWER SYSTEM ANALYSIS BY HADI SADAT, Mc GRAW Hill Pub.

2015-16/299, 2016-17/301,2017-18/296. **ELECTIVE-II**

EEE 423-3 HIGH VOLTAGE ENGINEERING

INSTRUCTION	**: 4 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 70**
SESSIONAL MARKS	**: 30**
CREDITS	**: 4**

Unit 1: Generation of high voltages: Direct voltages - A.C. to D.C. conversion, Electrostatic generators, Alternating voltages - Testing transformers, Series resonant circuits, Impulse voltages - Impulse voltage generator circuits, Operation, design and construction of impulse generators.

Unit 2: Measurement of High Voltages & Currents: Measurement of high DC voltages, AC Voltages and Impulse Voltages. Measurement of high Currents – direct, alternating and impulse. CRO for impulse voltage and current measurements.

Unit 3: Non-destructive testing of Materials and Electrical apparatus: Measurement of direct current resistivity, Measurement of dielectric constant and loss factor, Partial discharge measurements.

Unit 4: High voltage testing of Electrical Apparatus: Testing of insulators, bushings, isolators, circuit breakers, cables, transformers, and surge arrestors. Radio interference measurements.

Employability

Unit 5: Design, Planning and Layout of high voltage laboratories: Test facilities provided in HV laboratories, activities and studies in HV and UHV labs, Classification of HV labs, Size and ratings of large size HV labs, Grounding of impulse testing laboratories, Insulation coordination.

Employability

TEXT BOOKS:

1. High Voltage Engineering Fundamentals, E. Kuffel, W.S. Zaengl, J. Kuffel (Second edition), Newnes
2. High Voltage Engineering, M.S.Naidu & V.Kamaraju, (Third Edition), TMH.

REFERENCE BOOKS:

1. C.L.Wadhawa – High Voltage Engineering.
2. High Voltage Laboratory techniques by J.D.Craggs & Meak Butter Worths scientific publications, London.
3. High Voltage measurement techniques by Schawab, M.I.T Press Cambridge, Massachusetts

ELECTIVE II
EEE 423 Non- Conventional Energy sources

Instruction	:	4 periods per week
University Examination	:	3 hours
University Examination Marks	:	70
Sessional Marks	:	30

Introduction to energy sources: Conventional, non –Conventional renewable energy sources advantages prospects

Solar energy: Basic principles components of wind energy conversion system (wecs) classification of wecs, applications.

Employability

Bio-energy: Introduction, biomass-energy conversion wet & dry processes, classification of biogas plants, constructional details of few main digesters, biogas form wastes, applications.

Employability

Geo-thermal energy: Introduction, sources, prime movers, for Geo-thermal energy, applications.

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.

Fuel Cells: Introduction, classification, types, conversion efficiency, applications.

Employability

Text Books:

1. Non-Conventional Energy sources, by G.D. Rai, Khanna pub.

References Books:

Energy technology Non- Conventional, Renewable & Convectional By S. Rao Khanna pub.

Future sources of electrical power by M.P. Agarwal First ed. S. Chand & Co, 1999.

ELECTIVE-II
EEE423 DATA STRUCTURES

INSTRUCTION	**: 4 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 70**
SESSIONAL MARKS	**: 30**
CREDITS	**: 4**

REVISION OF ‘C’ LANGUAGE: OVER-VIEW ONLY(no questions to be set on this)

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.

STRUCTURES, POINTERS & FILES: DEFINITION OF STRUCTURE AND UNION, PROGRAMMING EXAMPLES, POINTER, POINTER EXPRESSIONS, PROGRAMMING EXAMPLES, FILE OPERATIONS AND PREPROCESS.

LINEAR DATA STRUCTURES: STACK REPRESENTATION, OPERATION, QUEUE REPRESENTATION, OPERATIONS, CIRCULAR QUEUES, LIST REPRESENTATION, OPERATIONS, DOUBLE LINKED AND CIRCULAR LISTS.

NON-LINEAR DATA STRUCTURE: TREES, BINARY TREE REPRESENTATION, TREE TRANSVERSALS, CONVERSION OF A GENERAL TREE TO BINARY TREE, REPRESENTATION OF GRAPHS.

SEARCH TECHNIQUES: BASIC SEARCH TECHNIQUES, TREE SEARCHING GRAPHICS, LINKED REPRESENTATION OF GRAPHS, GRAPH TRANSVERSAL AND SPANNING TREES.

TEXT BOOKS:

1. PROGRAMMING IN ANSI C BY E. BALAGURUSWAMY
2. DATA STRUCTURES USING C BY A.M. TANENBAUM AND OTHERS.

REFERENCE BOOKS:

1. AN INTRODUCTION TO DATA STRUCTURES WITH APPLICATIONS BY TRMBLY & SORENSON
2. THE ‘C’-PROGRAMMING LANGUAGE BY KERNIGAN & WRITCHI

2015-16/303, 2016-17/305,2017-18/300.

EEE424 – POWER SYSTEM SIMULATION LAB

INSTRUCTION	**: 3 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 50**
SESSIONAL MARKS	**: 50**
CREDITS	**: 4**

2015-16/304, 2016-17/306,2017-18/301.

EEE425-CONTROL SYSTEMS LABORATORY

INSTRUCTION	**: 3 Periods per Week**
UNIVERSITY EXAMINATION	**: 3 Hours**
UNIVERSITY EXAMINATION MARKS	**: 50**
SESSIONAL MARKS	**: 50**
CREDITS	**:2**

TEN EXPERIMENTS BASED ON E-321, EEE-415 & EEE-422 SYLLABI

2015-16/305, 2016-17/307,2017-18/302.

EEE426-PROJECT WORK

INSTRUCTION	**: 6 Periods per Week**
UNIVERSITY EXAMINATION	**: VIVA-VOCE**
UNIVERSITY EXAMINATION MARKS	**: 100**
SESSIONAL MARKS	**: 100**
CREDITS	**: 8**

APPLIED PHYSICS
(forEEE,ECE&Mech)

MEC 124 **Credits:3**
Instruction : 3 Periods & 1 Tut/Week Sessional Marks :40
End Exam : 3 Hours End Exam Marks:60

Course Objectives:

- To enhance student's knowledge of theoretical and modern technological aspects in physics and to introduce fundamentals of physics relevant to engineering applications
- To introduce advances in technology for engineering applications

Course Outcomes:

By end of the course, student will be able to:	
1	Understand the properties of magnetic materials and superconductivity.
2	Understand the dielectric nature of materials, properties and its applications.
3	Aware about nano material properties, synthesis and characterization tools.
4	Familiar with fundamentals of crystal structures.
5	Learn the basic phenomenon involved in semiconductors and semiconductor devices.

SYLLABUS

UNITI 12 Periods

Magnetic materials: Definition of magnetic permeability, magnetization and magnetic susceptibility, origin of magnetic moment, classification of magnetic materials, properties of diamagnetic and paramagnetic materials, ferromagnetic materials - hysteresis curve , domain theory of ferromagnetism, soft and hard ferromagnetic materials, anti-ferromagnetic and ferrimagnetic materials , ferrites and its applications

Superconductivity: Introduction, properties of superconductors, effect of temperature and magnetic field, Meissner effect, flux quantization , type – I and type – II superconductors high temperature superconductors, applications of superconductors, BCS theory (qualitative)

UNITII 10 Periods

Dielectric materials: Definition of electric dipole moment, dielectric polarization and dielectric constant, types of polarization – electronic, ionic and oriental polarization, expression for polarisability, internal fields in solids, Classius – Mossotti equation, frequency dependence of electronic polarization ,properties of ferroelectric materials and their applications

UNIT III 10 Periods

Nanophase materials: Introduction to nanophase materials, properties of nanophase materials, synthesis of nanophase materials – chemical vapour deposition, sol-gel method, MEChanical attrition method, applications of nanophase materials. Principles of X-Ray florescence X-Ray Diffraction- Electron Microscopy (SEM and TEM)

UNITIV 10 Periods

Crystal structure: Introduction, fundamental terms of crystallography – space lattice, , crystal lattice, unit cell, planes, seven crystal systems – Bravias lattices, cubic lattices, crystal directions and planes, Miller indices, interplanar spacing and interatomic distance , some simple crystal structures, body-centered cubic crystals, face-centered cubic crystals

UNIT V 12 Periods

Semiconductor Physics: Intrinsic and extrinsic semiconductors, Fermi level, carrier concentration in intrinsic semiconductor, continuity equation, direct and indirect band gap semiconductors. Lorentz force, Hall effect and its applications. Physics of semiconductor devices: open circuited p-n junction diode, energy diagram of p-n diode, working of a diode, volt-ampere characteristics of p-n junction, diode as a rectifier, light emitting diode (LED) , liquid crystal display (LCD), photodiode

TEXTBOOKS:

1. S.L Gupta and SanjeevGupta*Engineering physics*DhanpatRai publications.

2. M.N. Avadhanulu&P.G.Kshirasagar*A text book of engineering physics*, S.Chand publication

REFERENCE BOOKS:

1) V.Rajendran*Engineering physics* Tata McGraw Hill Education Private Limited

2) DattuRamanlal Joshi *Engineering Physics* Tata McGraw Hill Education Private Limited

3) A.Marikani*Engineering Physics* PHI Learning Private Limited

ADVANCED ENGINEERING DRAWING

MEC 125 — **Credits : 3**

Instruction : 3Periods& 1Tut/Week — Sessional Marks : 50

End Exam : 3 Hours — End Exam Marks : 50

Course Objectives:

- To make the student familiar to the drawing practices and convection
- To familiarize the student about various engineering curves and various layouts used in industry
- To enable the student draft simple engineering components and analyze basing on different views of components.

Course Outcomes:

By end of the course, student will be able to:	
1.	Draw orthographic projections for sections of solids.
2.	Draw the development of surface for solids.
3.	Prepare orthographic projections for intersections of solids.
4.	Convert isometric projections into orthographic projections and vice-versa.
5.	Develop 2-D and 3-D models using Auto-CAD.

LIST OF EXERCISES: Skill development

1. Sections of solids – Sectional views of prism, cylinder, pyramid and cone in simple positions

Skill development

2. Sectional views of prism, cylinder pyramid and cone inclined to both the planes

Skill development

3. Development of surfaces of prisms. Cylinder
4. Development of surfaces of pyramid, cone
5. Intersection of prism & prism, cylinder to cylinder, cylinder to cone, when two axes are perpendicular to each other
6. Intersection of cylinder to cylinder when axes are in inclined position
7. Conversion of orthographic views to isometric views (simple cases)

Skill development/
Employability

8. Conversion of isometric views to orthographic views.
9. 3D – Modeling using Auto CAD
   a. Prisms and Cylinders
   b. Pyramids and Cones
   c. Combination of Solids

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*

OBJECT ORIENTED PROGRAMMING WITH C++ LAB

608

(Common for all branches, except for Civil & Chemical branches)

MEC-128 **Credits :3** Instruction : 2 Periods/Week & 3 Practicals/week
Sessional Marks :50 End Exam:3 Hrs, End Exam Marks : 50

Course Objectives :

- To introduce Object Oriented Programming (OOP) using the C++ Language.
- To provide the basic concepts and techniques which form the Object Oriented Programming paradigm.

Course Outcomes:

By the end of the course, student will be able to:	
1.	Understand how to use the programming constructs of CPP.
2.	Use Object Oriented Programming concepts to develop object oriented programs.
3.	Apply various object oriented features to solve real world computing problemsusing C++ language.

SYLLABUS

List of the experiments to be done on the following topics

1. Overview (Transition from C)
2. OOP Concepts and Characteristics
3. Preprocessor , Command line arguments
4. Classes & Data Abstraction
5. Objects
6. Operator Overloading
7. Inheritance
8. Virtual Functions & Polymorphism
9. I/O Streams
10. Templates
11. File Processing
12. Exception Handling Concepts

REFERENCE BOOKS:

1. Mahesh Bhave , Sunil patekar*Object Oriented Programming in C++* Second edition , Pearson
2. R Rajaram, *Object Oriented Programming in C++* 2nd Edition New Age International Publishers

3. Herbert Schildt*C++ the Complete Reference* III edition, TMH 1999

4. E Balaguruswamy*Object Oriented Programming with C++*3rd Edition, McGraw Hill

LIST OF SAMPLE PROGRAMS

1. Write a C++ program that uses a recursive function for solving Towers of Hanoi problem.
2. Write a C++ program to find both the largest and smallest number in a list of integers.
3. Write a C++ program that uses function templates to solve problems 1 and 2 experiments
4. Write a C++ program to implement the matrix ADT using a class. Use operator overloading for implementation
5. Write the definition for a class called **Rectangle** that has floating point data members length and width. The class has the following member functions: **void setlength(float)** to set the length data member **void setwidth(float)** to set the width data member **float perimeter()** to calculate and return the perimeter of the rectangle **float area()** to calculate and return the area of the rectangle **void show()** to display the length and width of the rectangle **intsameArea(Rectangle)** that has one parameter of type Rectangle. sameArea returns 1 if the two Rectangles have the same area, and returns 0 if they don't.

1. Write the definitions for each of the above member functions.
2. Write main function to create two rectangle objects. Set the length and width of the first rectangle to 5 and 2.5. Set the length and width of the second rectangle to 5 and 18.9. Display each rectangle and its area and perimeter.
3. Check whether the two Rectangles have the same area and print a message indicating the result. Set the length and width of the first rectangle to 15 and 6.3. Display each Rectangle and its area and perimeter again. Again, check whether the two Rectangles have the same area and print a message indicating the result

6. Create a class called MusicIns to contain three methods string(),wind() and perc(). Each of these methods should initilialize string array to contain the following

   i. Veena, guitear, sitar, sarod and mandolin under string

   ii. Flute, clarinet, saxophone, nadaswaram and piccolo under wind

   iii. Table, mridangam, bangos, drums and tambour under perc

   It should also display the contents of the arrays initialized , create a sub class call TypeIns to contain a method called get() and show(). The get() methods must display a menu as follows

- String instruments
- Wind instruments
- Percussion instruments

The show method should display the relevant details according to user choice .the base class variable must be accessible only to its derived classes.

7. Create a base class called shape. It should contain two methods getCoord(), showCoord() to accept x and y co ordinates and to display the same respectively . Create a sub class called Rect. It should contain method to display length and breadth of the rectangle called showCoord() . In main method, execute the showCoord() of Rect class by applying the dynamic method dispatch concept

8. Create a class called car. Initialize the color and body attributes to “blue” and “wagon”. there should be two constructors one is a default the creates blue wagon the other constructor should take two argcolor, body and initialize. write method toString() that returns the color and body. Create a sub class funcar. In sub class there are two constructors to invoke super class constructors resp. Write a method playCD in sub class that displays the message “Beautiful music fills the passenger compartment” execute the methods to show the messages

1. Mycar is a blue wagon

2. My father’s car is red convertible.

9. Create the ZooAnimal constructor function. The function has 4 parameters — a character string followed by three integer parameters. In the constructor function dynamically allocate the name field (20 characters), copy the character string parameter into the name field, and then assign the three integer parameters to cageNumber, weightDate, and weight respectively.

10. Write a C++ program to perform operations on complex numbers using operator overloading

11. Write a C++ program to write number 1 to 100 in a data file NOTES.TXT

12. Write a function in C++ to count and display the number of lines not starting with alphabet ‘A’ present in a text file “STORY.TXT”.
    Example:
    If the file “STORY.TXT” contains the following lines,
    The rose is red.
    A girl is playing there.
    There is a playground.
    An aeroplane is in the sky.
    Numbers are not allowed in the password.
    The function should display the output as 3

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.

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.
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

Emplyability

Metallurgy , Powder Manufacture, Powder Blending, Powder Compaction, Sintering. Advantages & limitations.

Employability

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:

Centroids & Centre of Gravity: Centroids of lines & areas, C.G of volumes –determination by first principles, composite areas- Theorem of Pappus-Guldinus.

Employability

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:

Skill development

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

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

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.

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

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 2^{nd} 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

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.

EMPLOYABILITY

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

Introduction to Manufacturing:

Product cycle; Job, batch and mass production; Primary and secondary manufacturing processes.

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.

Employability

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

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

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

Skill Development

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.

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, 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 , 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

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

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.

UNIT-V

EMPLOYABILITY

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

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

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.
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.

Cams with specified contours: Tangent cam with roller follower – circular arc cam with flat faced follower.

Employability

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.

Employability

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

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

Screw Threads, Screw Fasteners, Locking arrangements, Foundation bolts and Riveted joints using standard Empirical formulae

Skill development/ Employability

UNIT-III

Skill development/ Employability

Keys, Cotter-joints, Pin-joints, Shaft couplings: Box and split muff couplings, Flanged couplings, Flexible couplings, Universal and Oldham couplings

Skill development/ Employability

UNIT-IV

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.

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

Employability

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.

Employability

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).

Employability

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

Employability

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 **(12+2)**

Employability

Computer Graphics

Employability

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.

Employability

Unit-III **(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 Employability **(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 Employability **(8+0)**

Artificial Intelligence:

Introduction to Artificial Intelligence - Applications of AI in design and CAD. Employability

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.

EMPLOYABILITY

UNIT-II **(10+5)**

Hydraulic Turbines

General layout of hydro power plant, heads and efficiencies of turbines, classification of turbines.

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.

EMPLOYABILITY

UNIT-III **(7+2)**

Performance of turbines

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.

EMPLOYABILITY

UNIT-IV **(10+5)**

Pumps

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)**

EMPLOYABILITY

Hydraulic systems & Fluidics

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

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.

EMPLOYABILITY

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 Employability **(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.

Turning moment diagrams:
Turning moment diagrams for I-C engines, fluctuation of energy, flywheels, and dimensions of flywheel rims.

Employability

UNIT –III **(10+5)**

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.

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 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*, 4th edition, McGraw-Hill Publications, New Delhi, 2014.
2. R.S.Khurmi & J.K.Gupta, *Theory of Machines*, 14th edition, S Chand & CO Ltd Publisher, 2005.

Reference books:

1. Thomas Bevan, *Theory of Machines* 3rd edition, CBS publishers & distributors, 2005.
2. P.L.Ballaney, *Theory of Machines and mechanisms*, 25th 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.

Employability

UNIT-II **(15+5)**

Employability

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.

Employability

UNIT-III **(10+5)**

Employability

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.

Employability

UNIT-IV **(10+5)**

Employability

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.

Employability

Employability

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.

Employability

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

Skill Development

Skill Development

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

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

Employability

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 **(10+5)**

CNC part programming

Employability

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.

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.

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 .

Acceptance tests on machine tools: Lathe, Milling machine, Radial drill, Laser equipment.

Employability

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)**

Entrepreneurship Skills / Employability

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.

Introduction to personnel management- Functions, Motivation, Theories of motivation, Hawthrone studies, Discipline in industry, Promotion, Transfer, lay off and discharge, Labour turnover.

Entrepreneurship Skills /

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)**

Entrepreneurship Skills / Employability

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.

UNIT-IV **(12+0)**

Entrepreneurship Skills / Employability

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.

UNIT-V **(9+3)**

Entrepreneurship Skills / Employability

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.

Employability

Employability

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.

Employability

UNIT-III **(8+4)**
.
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.

Employability

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.

Employability

Employability

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.

Employability

Employability

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)**

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 EMPLOYABILITY **(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.

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.

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.

Employability

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

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)**

Employability

INVENTORY AND QUEUING THEORY
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**	
CO		1	2	3	4	5	6	7	8	9	10	11	12	1	2
	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.

EMPLOYABILITY

UNIT-II **(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, lnter-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.

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.

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

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.

Text Books:

Employability

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)**

Employability

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 Employability

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.

Employability

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.

Employability

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.

Employability

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.

Employability

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.

Employability

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

Employability

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.

Employability

Employability

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.

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.

UNIT-V Employability **(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.

Employability

Solid Ground Curing: Principle of operation, machine details, process, mask generation, model making applications.

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.

Employability

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

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:

Group-1(Thermal Engineering)

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.

Skill Development

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)

MEC 411 – DESIGN OF MACHINE ELEMENTS - II

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week: 5 Th. Ses. : 30 Exam :70

Examination (Theory): 3hrs. Credits : 4

Course Objectives:

- To develop an ability to design a component, or a system, or a process to meet desired needs within realistic constraints.
- To develop an ability to select and design gears for efficient power transmission in different applications.
- To impart the fundamental knowledge involved in analyzing the forces acting on any component of an I.C. Engine and design them for their strength.
- To provide the basic design concepts for design of such components like Clutches, bearings, gears, chain drives and wire ropes used in power transmission.

Course Outcomes:

The Student will be able to:

CO-1	Design the various types of gears based on static and dynamic Loading.
CO-2	Design the various IC engine components like connecting rod, crankshaft etc subjected to combined Stresses.
CO-3	Design various types of Frictional Clutches and brakes used in Automobiles.
CO-4	Design and Analyze the Life of the bearings subjected to static and Dynamic Loads.
CO-5	Design Crane hook, wire ropes and chain drives subjected to various types of loads.

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	3	1	2						1	1
CO2	3	1	3	1	2						1	1
CO3	3	1	3	1	2						1	1
CO4	3	1	3	1	2						1	1
CO5	3	1	3	1	2						1	1

Classification of gears. Standard tooth systems. Spur, Helical, Bevel and Worm gears. Terminology of each. Tooth failure. Face width an beam strength. Lewis equation. Design for dynamic and wear loads. Force analysis of Bevel and Worm gears. Thermal design considerations of worm gears.

Employability

Employability

Engine parts: I.C. engine design. Design of cylinders and heads. Design of pistons. Design of cross-head, connecting rods and crank shafts.
Friction clutches. Torque capacity multi-plate clutches. Design considerations. Energy considerations and Temperature rise friction materials. Centrifugal clutches. Brakes. Energy equations. Band and block brakes. Internal expanding shoe brakes, self locking, brake design. Sliding contact bearings. Lubrication modes. Temperature effect on viscosity. Journal bearing design. Bearing modulus. McKee equations. Heating of bearings. Collar and thrust bearings. Roller and ball bearings. Static and dynamic load capacity. Equivalent bearing load. Load-life relationships. Load factor. Selection of bearings from manufacturers catalogue.
Design of crane hooks. Wire rope construction and classification. Stresses in wire ropes. Design for service like lifts and winches. Chain drives, Nomenclature: Brief outline and simple applications of composite materials.

Employability

Employability

Text books:

1. Design of Machine Elements by V.B. Bhandari, TMH publishing Co. Ltd., New Delhi.

References:

1. Machine Design by R.K. Jain, Khanna publications.
2. Mechanical Engineering Design by Joseph E. Shingley.

Employability

Employability

MEC 412 – HEAT AND MASS TRANSFER

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week: 5 Th. Ses. : 30 Exam :70

Examination (Theory): 3hrs Credits : 4

Course Objective:

To demonstrate basic knowledge of heat transfer by understanding different modes of heat transfer, thermal conductivity of materials, composite walls, cylinders and spheres, heat transfer in fins, steady and unsteady heat conduction, applications of non dimensional numbers in free and forced convection, thermal boundary layer, radiation heat transfer, concept of shape factor, parallel & counter flow heat exchangers, basic principles of mass transfer.

Course Outcomes:

CO-1	Students will able to understand the basics of steady and unsteady state heat conduction and its applications.
CO-2	Students will able to understand the basics of free and forced convection and its applications.
CO-3	Students will able to understand the basics of radiation and its applications.
CO-4	Students will able to understand the basics of steady mass transfer and its applications.
CO-5	Students will able to design thermal equipment such as Fins, Heat Exchangers etc.

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	3	3	3			2	1	1		1	
CO2	1	3	3	3			2	1	1		1	
CO3	1	3	3	3			2	1	1		1	
CO4	1	3	3	3			2	1	1		1	
CO5	1	3	3	3	1		2	1	2		3	

Introduction: Basic modes of heat transfer- Rate equations- Generalized heat conduction equation in Cartesian, Cylindrical and Spherical coordinate systems.
Steady state heat conduction solution for plain and composite slabs, cylinders and spheres- Critical thickness of insulation- Heat conduction through fins of uniform and variable cross section- Fin effectiveness and efficiency.

EMPLOYABILITY

EMPLOYABILITY

Unsteady steady state heat conduction- Transient heat conduction- Lumped system analysis, and use of Heisler charts.

Convection: Continuity, momentum and energy equations- Dimensional analysis- Boundary layer theory concepts- Free, and Forced convection- Approximate solution of the boundary layer equations- Laminar and turbulent heat transfer correlation- Momentum equation and velocity profiles in turbulent boundary layers- Application of dimensional analysis to free and forced convection problems- Empirical correlation.

Radiation: Black body radiation- radiation field, Kirchoff's laws- shape factor- Stefan Boltzman equation- Heat radiation through absorbing media- Radiant heat exchange, parallel and perpendicular surfaces- Radiation shields.

EMPLOYABILITY

Heat Exchangers: Types of heat exchangers- Parallel flow- Counter flow- Cross flow heat exchangers- Overall heat transfer coefficient- LMTD and NTU methods- Fouling in heat exchangers- Heat exchangers with phase change.

Boiling: Different regimes of boiling- Nucleate, Transition and Film boiling. Condensation: Laminar film condensation- Nusselt's theory- Condensation on vertical flat plate and horizontal tubes- Dropwise condensation.

Mass Transfer: Conservation laws and constitutive equations- Isothermal equimass, Equimolal diffusion- Fick's law of diffusion- diffusion of gases, Liquids- Mass transfer coefficient.

EMPLOYABILITY

Text Books:

1. Heat Transfer, by J.P.Holman, Int. Student edition, McGraw Hill book company.
2. Analysis of Heat transfer, by Eckert and Drake, Int.Student edition, McGraw Hill Kogakusha Ltd.

References:

1. Heat and Mass Transfer by R.K. Rajput, S. Chand & Co.
2. Heat and mass transfer by Sachjdeva.
3. Heat and mass transfer by Kothandaramanna, New Age International.

MEC 413 – FLUID MACHINERY AND SYSTEMS

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week: 5 Th. Ses. : 30 Exam :70

Examination (Theory): 3hrs. Credits : 4

Course Objectives:

To make the students to apply the knowledge of mathematics, science, and engineering to Fluid machinery and measure the forces exerted by the jet of water on various vanes. Also to make them understand the principles of hydraulic turbines, pumps and other equipments.

Course Outcomes:

Students will be able

CO-1	To Analyze the forces exerted by the jet on various stationary and moving vanes.
CO-2	To Determine the performance of different propulsion systems.
CO-3	To study and analyze the performance characteristic curves of hydraulic turbines and pumps at different working conditions.
CO-4	To Understand and analyze the performance of various hydraulic systems such as Hydraulic lift, ram etc.

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	3					1		1	1
CO2	3	2	3	3					1	2	1	
CO3	3	3	3	3		2	2	2	1	2	1	
CO4	3	3	3	3		2	2	2	1	2	1	

EMPLOYABILITY

Impact of jet and jet propulsion: Impact of jet on stationary surfaces- Impact of jet on hinged surfaces- A moving curved vane high tangential entry of water- Radial flow over the vanes- Jet propulsion.

Hydraulic Turbines: Classification- Pelton wheel- Reaction turbines- Inward and outward radial flow reaction turbines- Fancis turbine- Axial flow reaction turbine- Kaplan turbine- Draft tube- Types- Theory- and efficiency of draft tube.

Specific Speed: Determination- Significance- Unit quantities- Unit speed- Unit discharge and unit power- Characteristic curves of hydraulic turbines- Constant heat curves- Constant speed curves and Iso-efficiency curves- Governing of turbines.

EMPLOYABILITY

EMPLOYABILITY

Centrifugal Pumps: Main parts- Efficiency- Minimum speed for starting- Multi-stage centrifugal pumps- Specific speed of a centrifugal pump- Priming of a centrifugal pump- Characteristic curves- Main, Operational and constant efficiency curves- Cavitation- Effects- Cavitation in Hydraulic machines.

Reciprocating Pumps: Main parts- Classification- Velocity and acceleration variation in suction and delivery pipes due to piston acceleration- Effect of variation of velocity on friction in suction and delivery pipes- Effect of acceleration in suction and delivery pipes on indicator diagram- Effect of friction- Maximum speed of reciprocating pump- Air vessels.

Hydraulic Press- Hydraulic accumulator- Differential hydraulic accumulator- Hydraulic intensifier- Hydraulic ram- Hydraulic lift- Hydraulic crane- Fluid coupling- Hydraulic torque converter. Servo systems- Open and closed loop systems- Hydraulic and Pneumatic systems- Fluid power components- Fluidics- Efficiency of a fluidic device- Proportional or analog devices- Vortex diode, Vortex triode, Counting, Fluidic systems- Digital devices.

EMPLOYABILITY

Text Book:

1. Fluid Mechanics and Hydraulic Machinery, by R.K.Bansal, Laxmi publications.

Reference:

1. Fluid Flow Machines, by N.S.Govinda Rao, Tata McGraw Hill publishing company Ltd.

MEC 414 – STATISTICAL QUALITY CONTROL

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week: 5 Th. Ses. : 30 Exam :70

Examination (Theory): 3hrs. Credits : 4

Course Objectives:

- To acquaint the student with the basic knowledge of statistical quality control by understanding quality definitions, Taguchi's loss function Demings philosophy
- To prepare control charts for variables, X,R and Sigma charts, theory of runs, ARL and ATS , Type-I and Type-II errors,
- To prepare control charts for attributes, P-Chart, np-chart,c-chart, u-chart,
- To Design single and sequential sampling plans

Course Outcomes:

CO-1	Students will able to understand Taguchi's, Deming's principles.
CO-2	Students will be able to understand how to use the control charts and their significance
CO-3	Students will be able to understand how to use the sampling plans and their significance

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	1		3	1	2				3		3	
CO-2	1		3	1	2				3		3	
CO-3	1		3	1	2				3		3	

Employability

Introduction to quality, definitions, Taguchi's loss function, examples of off-line and on-line quality control techniques, quality costs, Deming's philosophy, introduction to six sigma concept.

Shewart's normal bowl, control charts for variables, $\bar{X}$, R and sigma control charts, theory of runs, ARL and ATS, Type-I and Type-II errors

Control charts for attributes, p-chart, standardized p –chart, np-chart, c-chart, u-chart, demerit control chart.

Employability

Process capability analysis: using frequency distribution and control charts. Process capability ratios, C_p and C_{pk} Process capability ratios for nominal the batter type, smaller the better type and larger the better type product specifications.

Sampling palns: single, double, multiple and sequential sampling plans, rectifying inspection, AOQ, AOQL, and ATI. Use of Dodge Romig Tables, Design of single and sequential sampling plans.

Employability

Text Books:

1. Introduction to statistical quality control by E.L. Grant
2. Introduction to statistical quality control by D.C. Montgomery

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**

UNIT-I:

EMPLOYABILITY

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.

UNIT-III:

EMPLOYABILITY

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.

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.

ELECTIVE II
EEE 423 Non- Conventional Energy sources

Instruction	:	4 periods per week
University Examination	:	3 hours
University Examination Marks	:	70
Sessional Marks	:	30

Introduction to energy sources: Conventional, non –Conventional renewable energy sources advantages prospects

Solar energy: Basic principles components of wind energy conversion system (wecs) classification of wecs, applications. EMPLOYABILITY

Bio-energy: Introduction, biomass-energy conversion wet & dry processes, classification of biogas plants, constructional details of few main digesters, biogas form wastes, applications. EMPLOYABILITY

Geo-thermal energy: Introduction, sources, prime movers, for Geo-thermal energy, applications EMPLOYABILITY

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. EMPLOYABILITY

EMPLOYABILITY

Fuel Cells: Introduction, classification, types, conversion efficiency, applications.

Text Books:

1. Non-Conventional Energy sources, by G.D. Rai, Khanna pub.

References Books:

Energy technology Non- Conventional, Renewable & Convectional By S. Rao Khanna pub.

Future sources of electrical power by M.P. Agarwal First ed. S. Chand & Co, 1999.

MEC 415 - ELECTIVE - III

MEC 415(C) – Computer Numerical Control and Computer Aided Manufacturing

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week: 5 Th. Ses. : 30 Exam :70

Examination (Theory): 3hrs. Credits : 4

Course Objectives:

1. To provide an introduction to the basic principles of computer integrated manufacturing and functioning of its components.
2. To strengthen the student's knowledge in the application of computerized numerically controlled machines in the areas of automobile components manufacturing, dies and moulds and other precision component manufacturing.
3. To make students understand features of different computer aided quality inspection methodologies and flexible manufacturing systems.
4. To impart basic concepts related to manual part programming through the use of loop statements in "C"-Language programming.
5. To expose students to execute simulations in cam software prior to machining in computerized numerically controlled machines.

Course Outcomes:

CO-1	Students will have clear idea about the principles of computer aided manufacturing and its functioning.
CO-2	Students can explain the significance of various methodologies that can be adopted in process planning and quality control.
CO-3	Students will have the ability to explain the operational features of group technology and components of flexible manufacturing and tool management systems.
CO-4	Students will be able to reach latest advancements in precision manufacturing by building upon the fundamentals learnt in this course.
CO-5	Students will learn the principles related to manual part programming and computer aided part programming for controlling various computerized numerically controlled machines.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	-	-	2	1	3	-	1	1	1	3	2	3
CO-2	2	3	3	3	1	-	-	2	2	3	3	3
CO-3	3	2	1	1	2	-	-	1	2	3	2	2
CO-4	3	-	1	2	3	-	-	2	3	2	3	3
CO-5	-	-	1	3	3	-	-	1	3	3	3	3

Introduction to CNC and CAM, CNC retrofitting, Adoptive control machining, NC part program preparation through computer languages. Group technology: Merits & demerits, Organisation, Classification and Coding systems, Facilities layout.

Computer aided process planning: Introduction to process planning, Methods of process planning, Computer aided process planning, CAPP systems, case studies.

Computer aided material handling and production planning: Robots: Structure and operation of Robots, robot sensors and applications. Automatic conveyor systems. Automated guided vehicles. Aid of computer in production planning and control, Inventory control and material requirement planning.

Computer aided inspection and quality control: Developments and practice, Quality assurance and quality control. Coordinate measuring machine. Non-contact inspection.

FMS & CIMS: Building blocks of Flexible Manufacturing Systems (FMS), Machining systems of FMS, Tool management systems, Advantages of FMS, Computer integrated manufacturing systems (CIMS).

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Text Books:

1. Computer Aided Manufacturing, by P.N.Rao, N.K.Tewari & T.K.Kundra, Tata McGraw-Hill publishing company Ltd, NewtDelhi.
2. Automation, Production Systems and Computer Integrated Manufacturing, by Mikell P.Groover, Prentice-Hall of India Pvt. Ltd.

Reference:

1. Computer Integrated Design and Manufacturing, by David D.Bedworth, Mark R.Henderson & Philip M.Wolfe, McGraw-Hill Book Company, Singapore.

MEC 415 - ELECTIVE - III
MEC 415(D) – TOTAL QUALITY MANAGEMENT

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week: 5 Th. Ses. : 30 Exam :70

Examination (Theory): 3hrs. Credits : 4

Course objectives:

To give a brief theoretical knowledge related to concepts of Quality , concepts of TQM, Quality philosophies, to illustrate TQM process, quality control tools, Quality policy deployment, Designing for Quality.

To demonstrate the steps for Implementation of TQM, focusing on KAIZEN,5S,JIT,Taguchi methods, by giving case studies from the Industry.

Course outcomes:

CO-1	Students will be able to understand the various Quality concepts, the role of the Top Management, for the successful implementation of TQM
CO-2	Students will be able to understand the various TQM concepts
CO-3	Students will be able to understand the various Quality systems like ISO 9000 systems
CO-4	Students will be able to understand the various Quality concepts like KAIZEN
CO-5	Students will be able to understand the various Quality concepts like Taguchi methods

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		3	1	1				3		3	
CO-2	1		3	1	2				3		3	
CO-3	1		3	2	2				3		3	
CO-4	1		3	1	1				3		3	
CO-5	1		3	1	1				3		3	

Entrepreneurship Skills

Concepts of TQM: Philosophy of TQM, Customer focus, Organization, Top management commitment, Team work, Quality philosophies of Deming, Crossby and Muller.
TQM process: QC tools, Problem solving methodologies, New management tools, Work habits, Quality circles, Bench marking, Strategic quality planning.
TQM systems: Quality policy deployment, Quality function deployment, Standardization, Designing for quality, Manufacturing for quality.
Quality system: Need for ISO 9000 system, Advantages, Clauses of ISO 9000, Implementation of ISO 9000, Quality costs, Quality auditing, Case studies.

Entrepreneurship Skills

Entrepreneurship Skills

Implementation of TQM: Steps, KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods, Case studies.

References:

1. Total Quality Management by Rose, J.E., Kogan Page Ltd., 1993.
2. The Essence of Total Quality Management by John Bank, PHI, 1993.
3. Beyond Total Quality Management by Greg Bounds, Lyle Yorks et al, McGraw Hill, 1994.
4. The Asian Productivity Organization by Takashi Osada, 1991.
5. KAIZEN by Masaki Imami, McGraw Hill, 1986.

MEC 415 - ELECTIVE - III
MEC 415(E) – OPTIMIZATION OF DESIGN

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week: 5 Th. Ses. : 30 Exam :70
Examination (Theory): 3hrs. Credits : 4

Course Objective:

To objective of the course is to familiarizing the students with optimization in design principles such as classical optimization techniques, nonlinear programming, dynamic programming, integer programming, and geometric programming to solve engineering problems.

Course Outcome:

CO-1	The Students will be able to model, solve and analyze problems using the concepts of non linear programming
CO-2	The Students will be able to model, solve and analyze problems using the concepts of dynamic programming
C0-3	The Students will be able to model, solve and analyze problems using the concepts of geometric programming
CO-4	The Students will be able to model, solve and analyze problems using the concepts of integer programming

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		3		3			3	3		3	
CO-2	2		3		2			3	3		3	
CO-3	1		2		3			2	1		3	
CO-4	1		1		3			1	2		1	

Introduction to Optimization: Engineering applications of optimization- Statement of an optimization problem- Classification of optimization problem- Optimization techniques. Classical Optimization Techniques: Single variable optimization- Multivariable optimization with equality constraints- Multivariable optimization with inequality constraints.
Nonlinear Programming: One-Dimensional Minimization: Unimodal function- Elimination methods- Unrestricted search- Exhaustive search- Dichotomous search- Fibonacci method- Golden section method- Interpolation
methods- Quadratic interpolation method- Cubic interpolation method- direct root method.
Nonlinear Programming: Unconstrained Optimization Techniques: Direct search methods- Random search methods- Univariate method- Pattern search method- Rosenbrock's method of rotating coordinates- The simplex method- Descent methods- Gradient of function- Steepest

Skill Development & Employability

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descent method- Conjugate gradient method (Fletcher-Reeves method)- Quasi-Newton methods- Variable metric method (Davidon- Fletcher-Powell method).

Nonlinear Programming: Constrained Optimization Techniques: Characteristics of a constrained problem- Direct method- The complex method- Cutting plane method- Methods of feasible directions- Indirect methods- Transformation techniques- Basic approach in the penalty function method- Interior penalty function method- Convex programming problem- Exterior penalty function method.

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). Complimentary geometric programming(C.G.P)

Dynamic programming(D.P): Multistage decision processes. Concepts of sub optimisation, computational procedure in dynamic programming calculus method and tabular methods. Linear programming as a case of D.P., Continuous D.P.

Integer programming(I.P): Graphical representation. Gomory's cutting plane method. Bala's algorithm for zero-one programming problem. Integer non linear programming.

Skill Development & Employability

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Text Book:

1. Optimization Theory and Applications, by S.S.Rao, Wiley Eastern Limited, New Delhi.

References:

1. Optimization of Design of Machine Elements, by R.C.Johnson.
2. Computer Aided Analysis and Design of Machine Elements, by Rao V.Dukkipati, M.Ananda Rao and R.B.Bhat.
3. Engineering optimization methods and applications, by G.V.Reklaits, A.Ravindarn and K.M.Ragsdell, by Publications John Wiley and Sons.

MEC 415 - ELECTIVE - III
MEC 415(F) – ENGINEERING TRIBOLOGY

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week: 5 Th. Ses. : 30 Exam :70
Examination (Theory): 3hrs. Credits : 4

Course objectives:

- To provide broad based understanding of the interdisciplinary subject ‘Tribology’ and its technological significance.
- To make students learn the principles for selecting compatible materials for minimizing friction and wear in machinery.
- To make students understand the fundamental principles of lubrication for reduction of friction and Wear.
- To give students understanding of the principles of bearing selection and bearing arrangement in machines.
- To teach students the computations required for selecting and designing bearings in machines.

Course outcomes:

The students will be able to:

CO-1	Apply the basic theories of friction, wear and lubrication to predictions about the frictional behaviour of commonly encountered sliding interfaces.
CO-2	Characterize features of rough surface and liquid lubricants as they pertain to interface sliding.
CO-3	Interpret the latest research on new topics in Tribology including its application to nano scale devices and biological systems.
CO-4	Relate the composition of lubricant film and its properties and operational conditions such as load, temperature and speed to make correct designs for the applications in the industry
CO-5	Calculate and measure properties of contacting surfaces such as roughness, friction coefficient and adhesive strength.
CO-6	Understand the tribological applications of metals, polymers, ceramics and bio materials.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	1	2	1	1		2		1	2		1
CO-2		1	2	3	3	2	1		2	1	1	1
CO-3	1	2	3	3	1	3	1	1		1	2	
CO-4	3	2	1	2	1	2		1		1	1	
CO-5	1	2		2	2	2	2		2	1	2	

Introduction: history, industrial significance, different types of bearings,

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Properties and testing of lubricants: viscosity, viscometry, effect of temperature and pressure on viscosity, physical properties of mineral oils, generalized Reynolds's equation

Engineering surfaces – properties and measurements: different measuring methods, statistical description, fractal description

Surface contact: Non –confirming Surface contact geometry, stresses in Non –confirming Surface, contact of surface roughness, numerical surface contact models

Adhesion, Friction, Wear: adhesion models, factors influencing adhesion, stiction, various types of frictions, laws of wear, types of wear, minor forms of wear, methods for reduction of wear and friction and ferrography, surface engineering

Boundary lubrication: Liquid lubrication, fluid film lubrication, liquid and solid lubricants, properties of lubricants, typical lubricant tests, additives, Fluid film lubrication

Bearings: hydrodynamic thrust bearings, hydrodynamic journal bearings, hydrodynamic squeeze film bearings, hydrostatic bearings, gas lubricated bearings and rolling element bearings and antifriction bearing, Nano tribology

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Text books:

1. Introduction to triobology of bearings, B.C. Majumdar, a.h. wheelers and co
2. Engineering triobology, Prasanta Sahu, Prentice - Hall of India, 2005
3. Fundamentals of Tribology, S.K.Basu, s.N. Sengupta and B.B.Ahuja, Prentice - Hall of India, 2005

2015-16/288, 2016-17/290,2017-18/285. **ELECTIVE-1**

EEE411-2 OPERATIONS RESEARCH

INSTRUCTION : 4 Periods per Week
UNIVERSITY EXAMINATION : 3 Hours
UNIVERSITY EXAMINATION MARKS : 70
SESSIONAL MARKS : 30

CREDITS : 4

INTRODUCTION TO OPTIMIZATION: ENGINEERING APPLICATIONS OF OPTIMIZATION, STATEMENT OF PROBLEM, CLASSIFICATION OF OPTIMIZATION PROBLEM TECHNIQUES.

LINEAR PROGRAMMING : INTRODUCTION, REQUIREMENTS FOR A LP PROBLEM, EXAMPLES ON THE APPLICATION OF LP, GRAPHICAL SOLUTION OF 2-VARIABLE LP PROBLEMS, SOME EXCEPTIONAL CASES, GENERAL MATHEMATICAL FORMULATION FOR LPP, CANONICAL AND STANDARD FORMS OF LP PROBLEM, SIMPLEX METHOD, EXAMPLES ON THE APPLICATION OF SIMPLEX TECHNIQUES. Employability

ARTIFICIAL VARIABLE TECHNIQUE: BIG-M METHOD AND TWO PHASE TECHNIQUES. Employability

TRANSPORTATION PROBLEM: MATRIX TERMINOLOGY, DEFINITION AND MATHEMATICAL REPRESENTATION OF TRANSPORTATION MODEL, FORMULATION AND SOLUTION OF TRANSPORTATION MODELS (BASIC FEASIBLE SOLUTION BY NORTH-WEST CORNER METHOD, INSPECTION METHOD. VOGELL'S APPROXIMATION METHOD) Employability

ASSIGNMENT PROBLEM: MATRIX TERMINOLOGY, DEFINITION OF ASSIGNMENT MODEL, COMPARISON WITH TRASPORTATION MODEL, MATHEMATICAL REPRESENTATION OF ASSIGNMENT MODEL, FORMULATION AND SOLUTION OF ASSIGNMENT MODELS. Employability

PERT NETWORK: INTRODUCTION, PHASES OF PROJECT SCHEDULING, NETWORK LOGIC, NUMBERING THE EVENTS (FULKERSON'S RULE), MEASURE OF ACTIVITY. Employability

PERT NETWORK COMPUTATIONS: FORWARD PASS AND BACKWARD PASS COMPUTATIONS, SLACK CRITICAL PATH, PROBABILITY OF MEETING THE SCHEDULED DATES. Employability

INVENTORY MODELS: INTRODUCTION, NECESSITY FOR MAINTAINING INVENTORY, CLASSIFICATION OF INVENTORY MODELS, INVENTORY MODELS WITH DETERMINISTIC DEMAND, DEMAND RATE UNIFORM-PRODUCTION RATE INFINITE, DEMAND RATE NON-UNIFORM PRODUCTION RATE FINITE, DEMAND RATE UNIFORM-PRODUCTION RATE FINITE. Employability

GAME THEORY: USEFUL TERMINOLOGY, RULES FOR GAME THEORY, SADDLE POINT, PURE STRATEGY, REDUCE GAME BY DOMINANCE, MIXED STRATEGIES, 2X2 GAMES WITHOUT SADDLE POINT.

Employability

TEXT BOOKS:

1. "OPERATIONS RESEARCH-AN INTRODUCTION' BY H.TAHA, PRENTICE HALL OF INDIA Pvt. Ltd.
2. "ENGINEERING OPTIMIZATION-THEORY & PRACTICE" BY S.S. RAO, NEW AGE INTERNATIONAL (P) Ltd.
3. "OPERATIONS RESEARCH – AN INTRODUCTION" BY P.K.GUPTA & D.S.HIRA, S.Chnd & Co. Ltd.

MEC 417 - HEAT AND MASS TRANSFER LAB

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week : 3 Pr. Ses. : 50 Exam : 50

Examination (Practical): 3hrs. Credits: 2

Course Objective:

To demonstrate basic knowledge of heat transfer by understanding different modes of heat transfer, thermal conductivity of materials, composite walls, cylinders and spheres, heat transfer in fins, steady and unsteady heat conduction, principles of radiation heat transfer.

Course Outcomes:

CO-1	Students will able to understand the basics of steady and unsteady state heat transfer and its applications.
CO-2	Students will able to understand how to calculate thermal conductivity for different materials for different heat input.
CO-3	Students will acquire knowledge about free and forced convection.
CO-4	Students will analyze the variation of temperature at different mediums.

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	3		2		1	2		2	
CO2	2	2	3	3		2		1	2		2	
CO3	2	2	3	3		2		1	2		2	
CO4	2	2	3	3		2		1	2		2	
CO5												

List of Experiments:

1. Study of conduction phenomena in the composite slab system.
2. Determination of emmissivity, time constant, Fouries Biot module and study of variation of temperature with respect to time on a circular disc.
3. Study of heat transfer by forced convection through a horizontal test section.
4. Study of heat transfer by forced convection through a vertical test section.
5. Determination of free convective heat transfer coefficient from a horizontal cylinder in air.
6. Determination of thermal conductivity of brass employing it as a fin.
7. Tests on natural convection and pool boiling.
8. Study of forced convection with turbulence promoters.
9. Study of condensation on fin.
10. Tests on film condensation.
11. Determination of COP of a vapour compression refrigeration system.
12. Study of vapour compression air conditioning system.

Employability

MEC 418 – FLUID MECHANICS AND MACHINERY LAB

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week : 3 Pr. Ses. : 50 Exam : 50

Examination (Practical): 3hrs. Credits: 2

Course Objectives:

- To demonstrate the students to measure the flow rate by using various instruments like venturi meter, orifice meter and Notches etc.
- To make students to determine the performance characteristics curves of turbines and pumps.

Course Outcomes:

Students will be able to:

CO-1	Measure the flow rate and efficiencies of turbines and pumps at various working conditions.
CO-2	Understand the experiments and draw the various performance characteristic curves of hydraulic machines.
CO-3	Analyze and design fluid systems.
CO-4	Safely execute experiments, analyze and interpret results and errors, and formulate conclusions

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	1	3				2	2		2	1
CO2	3	3	3	2		1		1	1		1	
CO3	3	3	3	3		1	2	1	1	1	1	
CO4				3				3	2	3	1	

.

List of Experiments:

1. Calibration of flow meters,
   a. Venturi meter
   b. Orifice meter
   c. Nozzle meter
2. Determination of coefficient of discharge for
   a. small orifice
   b. cylindrical mouth piece
3. Finding coefficient of discharge for
   a. rectangular notch
   b. triangular notch

Skill Development

   c. trapezoidal notch

4. To draw the performance characteristics of C.F. pump.
5. To find the specific speed of
   a. Pelton turbine
   b. Francis turbine
6. To draw the characteristic curves for reciprocating pump.
7. To draw the pressure distribution and finding coefficient of drag for
   a. a bluff body
   b. an Aero foil
8. To draw the characteristic curves for the hydraulic ram.

Skill Development

MEC 421 – INSTRUMENTATION AND CONTROL SYSTEMS

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week: 5 Th. Ses. : 30 Exam :70
Examination (Theory): 3hrs. Credits : 4

Instrumentations: Concepts of measurements, static performance, characteristics accuracy of measurement and its analysis. Instrumentation, for measurement: Force, torque, strain, pressure, flow, temperature and vibration.

skill development

Optical Methods of Measurement: Introduction, Laser beam as a light pointer, length/displacement measurement, temperature sensors, seismographic measurement.

Introduction to fiber optics, fiber types, properties of optical fibres and a fibre optic sensor configuration.

skill development

Introduction: Control systems, Feedback and its effects. Transfer Function, Block Diagram and Signal Flow Graph: Impulse response and Transfer functions of linear systems, Block diagrams.

Mathematical Modeling of Physical Systems: Equations of electrical networks, Modeling of mechanical system elements, Equations of mechanical systems. State-variable Analysis of Linear Dynamic Systems: Matrix representation of state equations, State transition matrix, State transition equation, relationship between state equations and high-order differential equations, relationship between state equations and transfer functions, Characteristic equation, eigen values and eigen vectors.

Time-Domain Analysis of Control Systems: Typical test signals for the time response of control systems, Time- domain performance of control systems- The steady- state error, Time-domain performance of control systems- Stability of control systems- stability, Characteristic equation and the state transition matrix, Methods of determining stability of linear control systems, Routh- Hurwitz criterion.

skill development

Frequency-domain Analysis of Control Systems: Introduction, Nyquist stability criterion, Application of the Nyquist criterion, Stability of multi loop systems, Stability of linear control systems with time delays.

Text Books:

1. Automatic Control Systems, by Benjamin C. Kuo.
2. Mechanical Measurements, by R.S.Sirohi, H.G. Radha Krishna, Wiley Eastern, New Delhi.

References:

1. Experimental Methods for Engineers, by J.P.Holman, McGraw-Hill.
2. Instrumentation for Engineering Measurements, by R.H. Cerni and L.E.Foster, J.Wiley & Sons, New York.
3. Mechanical and Industrial Measurement, by R.K.Jain, Khanna publishers, Delhi.
4. Control Systems Engineering by Nagrath/Gopal ,New age international.

MEC 422 – COMPUTER AIDED DESIGN

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week: 5 Th. Ses. : 30 Exam :70

Examination (Theory): 3hrs. Credits : 4

Course Objectives:

1. To enable students in using computers for design, analysis and optimization of machine elements.
2. To introduce synthesis and analysis phases of design using computers.
3. To educate students about various types of input-output devices of computers.
4. To introduce different modeling and analysis techniques to students.
5. To write algorithms for various design problems using CAD.

Course Outcomes:

Student will be able to

CO-1	Students can use 2D entities in drawing Machine Elements.
CO-2	Students can understand the difference between wireframe model, surface model and solid model.
CO-3	Students can implement FEM using CAD.
CO-4	Students can develop algorithms for Design Problems.
CO-5	Students can implement Artificial Intelligence to design problems using CAD.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	-	1	-	3	-	-	-	-	2	-	-
CO-2	3	-	3	-	2	-	-	-	-	1	-	-
CO-3	3	2	3	3	3	-	2	-	2	1	-	1
CO-4	2	2	-	-	1	-	-	-	1	-	-	1
CO-5	-	-	-	-	3	-	1	-	-	-	-	-

Skill Development & Employability

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- 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.

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.

CAD applications and exposure to CAD packages: Simple examples of computer aided drafting, design and analysis - Introduction to simple machine elements - Analysis of cross sectional area, centroid & moment of inertia- Kinematics of crank- slider mechanism and

Skill Development & Employability

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other simple design applications. Introduction to CAD packages like ANSYS, NASTRON, NISA-II.

Introduction to Artificial Intelligence Introduction to Artificial Intelligence - Applications of AI in design and CAD.

Skill Development & Employability

Text Books:

1. CAD/CAM- Computer Aided Design & Manufacturing, by M.D.Groover & E.W.Zimmer.
2. Computer Aided Design and Manufacturing, by Dr.Sadhu Singh, Khanna Publishers.

References:

1. Computer Aided Design in Mechanical Engineering, by V.Rama Murthy.
2. Elements of Computer Aided Design & Manufacturing, by Y.C.Pao.
3. Computer Aided Kinetics for Machine Design, by D.L.Ryan.
4. Computer Aided Design and Manufacturing, by C.B.Besant & C.W.K.Lui.
5. Computer-Aided Analysis & Design by S. Ghosal, Prentice Hall of India.
6. CAD/CAM/CIM by Radhakrishna, New age international.

MEC 424 - PROJECT
(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week : 6 Pr. Ses. : 50 Exam : 50
Credits: 8

Project topic to be decided by the guide/department.

Course Objectives:

To impart students:

Creative/Innovative thinking considering societal issues.
An ability to apply their theoretical knowledge in practical situation.
An ability to work in a team.
An ability to communicate effectively.

Course Outcomes:

The students will be able to develop:

CO_1	An ability to apply knowledge of mathematics, science, and engineering to design and conduct experiments, as well as to analyze and interpret data.
CO-2	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
CO-3	An ability to function on multi-disciplinary teams and engage themselves in life-long learning to be abreast with technological changes.
CO-4	An ability to identify, formulate, and solve engineering problems using latest technological and software tools and also to communicate effectively with the engineering community and society at large.

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			3								
CO2			3			3	3	3				
CO3									3		3	3
CO4		3			3					3		

MEC 425 - COMPUTER AIDED DESIGN LAB

(Effective from the batch admitted during 2006-2007- Credit System)

Periods/week : 3 Pr. Ses. : 50 Exam : 50
Examination (Practical): 3hrs. Credits: 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 modeling techniques are explained using solid works.
- Model the 3-D geometric information of machine components including assemblies, and automatically generate 2-D production drawings,
- To explain the Finite Element Analysis using ANSYS.
- To explain FMS using CNC lathe and 6-Axis Robo, and to give them knowledge of CNC programming for various operations on CNC lathe. 6-Axis Robo is used for material handling.

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.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	-	1	-	1	-	-	-	-	-	-	-
CO-2	3	-	3	-	3	-	-	-	-	1	-	-
CO-3	3	2	3	3	3	-	2	-	-	1	-	1
CO-4	2	2	2	1	3	-	1	-	1	-	-	1
CO-5	-	-	3	-	2	-	1	1	2	1	1	-

Skill Development & Employability

CAD experiments:

1. Initiating the graphics package; Setting the paper size, space; setting the limits, units; use of snap and grid commands.
2. Drawing of primitives (line, arc, circle, ellipse, triangle etc.)
3. Drawing a flange.
4. Drawing a Bushing assembly.

5. Dimensioning the drawing and adding text.
6. Setting the layers and application of the layers.
7. Isometric and orthographic projections.
8. Viewing in Three dimensions.
9. Removal of hidden lines - Shading and rendering.

Skill Development & Employability

CAM experiments:

1. Preparation of manual part programming for CNC turning/Milling.
2. Part programming preparation through AutoCAD.
3. APT part programming for 2D - contour.
4. Machining of one job on CNC machine tool.
5. Robot programming through Teaching Box method.
6. Robot programming through computer.

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.

Skill Development

UNIT-II:
Mathematical modeling of physical systems-equations of electrical networks-modeling of mechanical systems- equations of mechanical systems.

Skill Development

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.

Skill Development

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.

Skill Development

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.

Employability

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.

Employability

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.

Employability

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.

Employability

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.

Employability

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.

Employability

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).

Skill Development

UNIT-IV:
Vector Control & DTC of Induction Motor: Direct and Indirect vector control, sensor less vector control, direct torque and flux control.

Employability

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,

Skill Development

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).

Skill Development

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.

Skill Development

UNIT-V:

MEMS and Accelerometers: Introduction to MEMS, definitions, classification and applications. Introduction to the Accelerometer and types of accelerometers.

Employability

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.

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

UNIT-IV:

Time Scales: Introduction, problem statement and preliminaries, numerical algorithm, basic properties, relation to model aggregation, feedback control design, singularly perturbed linear systems.

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

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

Skill Development

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.

Skill Development

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.

Skill Development

UNIT-III: STACK: The Stack as an ADT, Stack operation, Array Representation of Stack, Link Representation of Stack, Application of stack – Recursion, Polish Notation.

Skill Development

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.

Employability

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).

Employability

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.

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

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.

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.

Skill Development

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.

Skill Development

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.

Skill Development

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).

Skill Development

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.

Skill Development

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]

Skill Development

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]

Skill Development

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]

Skill Development

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]

Employability

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]

Skill Development

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.

Skill Development

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

Skill Development

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.

Skill Development

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.

Skill Development

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

Skill Development

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.

Skill Development

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.

Skill Development

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.

Skill Development

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

Skill Development

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.

Employability

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.

Skill Development

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

Skill Development

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)

Employability

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.

Skill Development

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.

Employability

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.

Employability

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.

Employability

UNIT-IV:

Model predictive control-Batch Process control-Plant-wide control & monitoring- Plant wide control design

Employability

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.

Employability

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)

Skill Development

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, 2^{nd} edition.

REFERENCES

1. Bowles, J.E. (2007), "Foundation Analysis and Design", McGraw-Hill, New York, 5^{th} 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, 7^{th} 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, 2nd 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, 6th 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, 2nd 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.

UNIT – II

Employability

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

UNIT – IV

Employability

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.

UNIT – V

Employability

Employability

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.

REFERENCE BOOKS:

Employability

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.

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.

Employability

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

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

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,

Employability

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**

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

Geometric modeling: Geometric modeling techniques - Multiple view 2D input, Wire frame geometry, Surface models, Geometric entities - Curves and Surfaces, Solid modelers, Feature recognition.

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.

Graphic aids: Geometric modifiers, Naming scheme, Layers, Grids, Groups, Dragging and rubber banding.

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.

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.

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

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.

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

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. Employability

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.

UNIT-V: Employability

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**

UNIT-I: Employability

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.

UNIT-II: Employability

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**

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

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-

Legendre, Gauss- Chebyshev, Romberg Integration. Double integration: Trapezoidal method, Simpson s method.

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.

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.

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

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

Continuous systems:

EMPLOYABILITY

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.

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.

UNIT-III:

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.

3-D PROBLEMS: Tetrahedran element, Hexahedral elements – Jacobian matrix – Stiffness matrix.

UNIT-IV:

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.

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:

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

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.

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 kinematics, Inverse kinematics, Method of successive screw displacements, Wrist centre position.

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.

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.

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).

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

Employability

feeding alternatives - Material handling alternatives - Floor layout and system architecture alternatives.

Assembly workstation design**:** Strategic issues - Technical issues analysis.

Unit –IV

Employability

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.

Unit –V

Employability

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

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.

Employability

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.

Employability

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.

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

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.

UNIT-III:

EMPLOYABILITY

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

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*		CRE DITS
		LECT URE	*TUTO RIAL*	*PRAC TICA L*	*TOT AL*	*SESSIO NAL MARKS*	*SEMESTE R 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*		CREDI TS
		LECT URE	*TUTO RIAL*	*PRAC TICA L*	*TO TA L*	*SESSIO NAL MARKS*	*SEMESTE R 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)**

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)**

Course Outcomes:

Employability

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.

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.

Employability

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 ($ø_o$=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)

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)

Employability

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

.

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.

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:

Employability

COMPLEX PROGRAMMABLE LOGIC DEVICES (CPLD):

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

Employability

UNIT-III

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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.

y

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

bility

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

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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.

EMPLOYABILITY

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.

EMPLOYABILITY

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.

EMPLOYABILITY

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.

EMP

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.

EMPLOYABIL

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.

EM

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.

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.

Empolyability

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

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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.

EMPLOYABILITY

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.

EMPLOYABILITY

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- Testing on host machine, 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

Skill Development

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.

Skill Development

Employability

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

Nonblocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols.

Employability

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.

Employability skill

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.

Employability skill

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

Employability skill

Employability skill

References

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

EMPLOYABILITY

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

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.

EMPLOYABILITY

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

EMPLOYABILITY

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

EMPLOYABILITY

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

Skill Development

UNIT 1 INTRODUCTION: GPUs as Parallel Computers, Architecture of a Modern GPU, Why More Speed or Parallelism? Parallel Programming Languages and Models .

(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.**

Employability

(Text Books 1,2,3)

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.
(Text Book-1)

EMPLOYABILITY

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
(Text Book-5)

EMPLOYABILITY

EMPLOYABILITY

EMPLOYABILITY

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

(Text Book-3)

EMPLOYABILITY

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

EMPLOYABILITY

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.

Employability

UNIT-II

Telecommunication Systems: GSM, GPRS, Capacity Allocation: FAMA and DAMA, Broadcast Systems: Digital audio broadcasting (DAB), Digital video broadcasting (DVB), CDMA and 3G.

Employability

UNIT-III

Wireless LAN: IEEE 802.11, Architecture, Services, MAC-Physical Layer, IEEE 802.11a- 802.11b Standards, Bluetooth.

Employability

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

Employability

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.

Employability

Employability

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.

Employability skill

UNIT-III

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

Employability skill

FUZZY SYSTEMS: Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule based System, Defuzzification Methods, and Applications

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 Other Traditional Methods, 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)

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

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.

Employability

Employability

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

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,

Employabil

Optical Flow.

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

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.

Skill Development

10 hours

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.

Employability

4. Develop an application to implement data generalization and summarization technique. 5. Develop an application to extract association rule of data mining.

Skill Development

Skill Development

6. Develop an application for classification of data using Decision Tree

Skill Development

7. Develop an application for implementing clustering using any one technique

Skill Development

8. Develop an application for implementing Naïve Bayes classifier

Skill Development

9. Develop an application for implementing KNN

10. Study on various tools used in Data mining and Machine Learning. (ex : WEKA, SCIKIT LEARN)

Skill Development