

St. PETER'S UNIVERSITY

St. Peter's Institute of Higher Education and Research
(Declared under section 3 of UGC Act 1956)
Avadi, Chennai – 600 054.



B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING) PROGRAMME

(I to VIII SEMESTERS)

REGULATIONS AND SYLLABI

(REGULATIONS – 2013)

(Effective from the Academic Year 2013-'14)

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING) PROGRAMME

Regulations and Syllabi

(Effective from the Academic Year 2013-'14)

1. Eligibility:

(1) Candidates who passed the following Examination or any other equivalent Examination thereto and who appeared for the entrance test conducted by the University or approved institutions wherever prescribed are eligible for admission to Four Year B.E. (Electrical and Electronics Engineering) Programme.

Higher Secondary Examination with Mathematics, Physics and Chemistry conducted by the Government of Tamil Nadu or its equivalent in the relevant subjects.

(2) Candidates who passed Three Year Diploma in Technical Education in the concerned subject conducted by the Government of Tamil Nadu are eligible for admission to Second Year of Four Year B.E. (Electrical and Electronics Engineering) Programme.

2. Duration: Four Years comprising 8 Semesters. Each semester has a minimum 90 working days with a minimum of 5 hours a day.

3. Medium: English is the medium of instruction and examination.

4. Weightage for Continuous and End Assessment: The weightage for continuous Assessment (IA) and End Assessment (EA) be 25:75 unless the ratio is specifically mentioned in the scheme of Examinations.

5. Credit System: Credit system be followed with 18 credits for each semester and each credit is equivalent to 25-30 hours of effective study provided in the Time Table.

6. Scheme of Examinations

I Semester

Code No.	Course Title	Credit	Marks		
			CA	EA	Total
Theory					
113EHT01	Technical English - I	1	25	75	100
113MAT02	Mathematics - I	3	25	75	100
113PHT03	Engineering Physics - I	3	25	75	100
113CYT04	Engineering Chemistry - I	3	25	75	100
113CPT05	Computer Programming	2	25	75	100
113EGT06	Engineering Graphics	3	25	75	100
Practical					
113CLP01	Computer Practices Laboratory	1	25	75	100
113ELP02	Engineering Practices Laboratory	1	25	75	100
113PCP03	Physics and Chemistry Laboratory - I	1	25	75	100
	Total	18	225	675	900

II Semester

Code No.	Course Title	Credit	Marks		
			CA	EA	Total
Theory					
213EHT01	Technical English - II	1	25	75	100
213MAT02	Mathematics - II	3	25	75	100
213PHT03	Engineering Physics - II	3	25	75	100
213CYT04	Engineering Chemistry - II	3	25	75	100
213CMT05	Basic Civil and Mechanical Engineering	3	25	75	100
213CTT06	Circuit Theory	2	25	75	100
Practical					
213PCP01	Physics and Chemistry Laboratory - II	1	25	75	100
213CPP02	Computer Programming Laboratory	1	25	75	100
213ELP03	Electric Circuits Laboratory	1	25	75	100
Total		18	225	675	900

III Semester

Code No.	Course Title	Credit	Marks		
			CA	EA	Total
Theory					
313MAT01	Transforms and Partial Differential Equations	3	25	75	100
313EET02	Digital Logic Circuits	3	25	75	100
313EET03	Electromagnetic Theory	3	25	75	100
313EET04	Environmental Science and Engineering	2	25	75	100
313EET05	Electronic Devices and Circuits	3	25	75	100
313EET06	Linear Integrated Circuits and Applications	2	25	75	100
Practical					
313EEP01	Electronics Laboratory	1	25	75	100
313EEP02	Linear and Digital Integrated Circuits Laboratory	1	25	75	100
Total		18	200	600	800

IV Semester

Code No.	Course Title	Credit	Marks		
			CA	EA	Total
Theory					
413EET01	Numerical Methods	3	25	75	100
413EET02	Electrical Machines - I	3	25	75	100
413EET03	Object Oriented Programming	2	25	75	100
413EET04	Transmission and Distribution	3	25	75	100
413EET05	Discrete Time Systems and Signal Processing	2	25	75	100
413EET06	Measurements and Instrumentation	3	25	75	100
Practical					
413EEP01	Object Oriented Programming Laboratory	1	25	75	100
413EEP02	Electrical Machines Laboratory - I	1	25	75	100
Total		18	200	600	800

V Semester

Code No.	Course Title	Credit	Marks		
			CA	EA	Total
Theory					
513EET01	Power System Analysis	3	25	75	100
513EET02	Microprocessors and Microcontrollers	2	25	75	100
513EET03	Power Plant Engineering	3	25	75	100
513EET04	Power Electronics	2	25	75	100
513EET05	Electrical Machines - II	3	25	75	100
513EET06	Control Systems	2	25	75	100
Practical					
513EEP01	Control and Instrumentation Laboratory	1	25	75	100
513EEP02	Communication and Soft Skills Lab	1	25	75	100
513EEP03	Electrical Machines Laboratory - II	1	25	75	100
Total		18	225	675	900

VI Semester

Code No.	Course Title	Credit	Marks		
			CA	EA	Total
Theory					
613EET01	Communication Engineering	2	25	75	100
613EET02	Solid State Drives	2	25	75	100
613EET03	Embedded Systems	3	25	75	100
613EET04	Power System Operation and Control	3	25	75	100
613EET05	Design of Electrical Machines	3	25	75	100
Elective - I:		2	25	75	100
Practical					
613EEP01	Power Electronics and Drives Laboratory	1	25	75	100
613EEP02	Microprocessors and Microcontrollers Laboratory	1	25	75	100
613EEP03	Presentation Skills and Technical Seminar	1	25	75	100
Total		18	225	675	900

VII Semester

Code No.	Course Title	Credit	Marks		
			CA	EA	Total
Theory					
713EET01	High Voltage Engineering	3	25	75	100
713EET02	Protection and Switchgear	3	25	75	100
713EET03	Special Electrical Machines	3	25	75	100
713EET04	Principles of Management	2	25	75	100
Elective - II:		2	25	75	100
Elective - III:		3	25	75	100
Practical					
713EEP01	Power System Simulation Laboratory	1	25	75	100
713EEP02	Comprehension	1	25	75	100
Total		18	200	600	800

VIII Semester

Code No.	Course Title	Credit	Marks		
			CA	EA	Total
Theory					
813EET01	Electric Energy Generation, Utilization and Conservation	2	25	75	100
Elective - IV:		3	25	75	100
Elective - V:		3	25	75	100
Project					
813EEP01	Project Work	10	25	65	100
	Viva Voce			10	
Total		18	100	300	400

Electives

Course Code	Electives	Credit
ELECTIVE - I		
613EET06	Visual Languages and Applications	2
613EET07	Advanced Control System	2
613EET08	Power System Transients	2
613EET09	Optimisation Techniques	2
ELECTIVE - II		
713EET05	Fibre Optics and Laser Instruments	2
713EET06	Biomedical Instrumentation	2
713EET07	Flexible AC Transmission Systems	2
713EET08	Power Quality	2
713EET09	Applied Soft Computing	2
ELECTIVE - III		
713EET10	Fundamentals of Nanoscience	3
713EET11	System Identification and Adaptive Control	3
713EET12	Micro Electro Mechanical Systems	3
713EET13	Microcontroller Based System Design	3
ELECTIVE - IV		
813EET02	Power Electronics for Renewable Energy Systems	3
813EET03	High Voltage Direct Current Transmission	3
813EET04	Power System Dynamics	3
813EET05	Principles of Robotics	3
ELECTIVE - V		
813EET06	Professional Ethics in Engineering	3
813EET07	Total Quality Management	3
813EET08	Advanced Digital Signal Processing	3
813EET09	Computer Aided Design of Electrical Apparatus	3
813EET10	VLSI Design	3

- 7. Passing Requirements:** The minimum pass mark (raw score) be 50% in End Assessment (EA) and 50% in Internal Assessment (IA) and End Assessment (EA) put together. No minimum mark (raw score) in Internal Assessment (IA) be prescribed unless it is specifically mentioned in the Scheme of Examination.
- 8. Grading System:** Grading System on a 10 Point Scale be followed with 1 mark = 0.1 Grade point to successful candidates as given below.

CONVERSION TABLE

(1 mark = 0.1 Grade Point on a 10 Point Scale)

Range of Marks	Grade Point	Letter Grade	Classification
90 to 100	9.0 to 10.0	O	First Class
80 to 89	8.0 to 8.9	A	First Class
70 to 79	7.0 to 7.9	B	First Class
60 to 69	6.0 to 6.9	C	First Class
50 to 59	5.0 to 5.9	D	Second Class
0 to 49	0 to 4.9	F	Reappearance

Procedure for Calculation

Cumulative Grade Point Average (CGPA)	=	$\frac{\text{Sum of Weighted Grade Points}}{\text{Total Credits}}$
	=	$\frac{\sum (CA+EA) C}{\sum C}$
Where Weighted Grade Points in each Course	=	Grade Points (CA+EA) multiplied by Credits
	=	(CA+EA)C
Weighted Cumulative Percentage of Marks(WCPM)	=	CGPAx10

C- Credit,

CA-Continuous Assessment,

EA- End Assessment

9. Pattern of the Question Paper: The question paper for End Assessment will be set for three hours and for the maximum of 100 marks with following divisions and details.

Part A: 10 questions (with equal distribution to all units in the syllabus).
Each question carries 2 marks.

Part B: 5 question with either or type (with equal distribution to all units in the syllabus). Each question carries 16 marks.

The total marks scored by the candidates will be reduced to the maximum prescribed in the Regulations.

10. Effective Period of Operation for the Arrear Candidates : Two Year grace period is provided for the candidates to complete the arrear examination, if any.

Registrar

11. Syllabus

I Semester

113EHT01 - TECHNICAL ENGLISH – I

AIM:

To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:

1. To help students develop listening skills for academic and professional purposes.
2. To help students acquire the ability to speak effectively in English in real-life situations.
3. To inculcate reading habit and to develop effective reading skills.
4. To help students improve their active and passive vocabulary.
5. To familiarize students with different rhetorical functions of scientific English.
6. To enable students write letters and reports effectively in formal and business situations.

UNIT I

General Vocabulary - changing words from one form to another - Adjectives, comparative adjectives - Adverbs - Active and passive voice - Tenses - simple present, present continuous - Adverb forms - Nouns - compound nouns - Skimming and scanning - Listening and transfer of information - bar chart, flowchart - Paragraph writing, description - Discussing as a group and making an oral report on the points discussed, conversation techniques - convincing others.

Suggested activities:

1. Matching words & meanings - Using words in context - Making sentences.
2. Changing sentences from active to passive voice & vice versa.
3. Skimming, cloze exercises, exercises transferring information from text to graphic form - bar charts, flow charts.
4. Writing descriptions using descriptive words & phrases, and technical vocabulary.
5. Role play, conversation exercises, discussions, oral reporting exercises
Any other related relevant classroom activity

UNIT II

Vocabulary - prefixes & suffixes - simple past tense - Spelling and punctuation - 'wh' Question forms - Scanning, inference - Listening & note-taking - Paragraph writing - comparison and contrast - Creative thinking and speaking.

Suggested Activities:

1. (a) Vocabulary activities using prefixes and suffixes.
(b) Exercises using questions - asking & answering questions.
2. Scanning the text for specific information
3. Listening guided note-taking - Writing paragraphs using notes, giving suitable headings and subheadings for paragraphs. Using expressions of comparison and contrast.
4. Discussion activities and exploring creative ideas. Any other related relevant classroom activity

UNIT III

Tenses - simple past, simple future and past perfect - Reading in Context -Listening & note-taking - single line - Definitions - sequencing of sentences - instruction - Persuasive speaking.

Suggested activities:

1. Providing appropriate context for the use of tenses
2. Listening and note-taking
3. (a) Writing sentence definitions, instructions
(b) Identifying the discourse links and sequencing jumbled sentences / writing instructions.
4. Speaking exercises, discussions, role play exercises using explaining, convincing and persuasive strategies Any other related relevant classroom activity

UNIT IV

Modal verbs and Probability – Concord subject verb agreement – Correction of errors - Cause and effect expressions – Extended Definition - Speaking about the future plans.

Suggested activities:

1. (a) Making sentences using modal verbs to express probability
(b) Gap filling using relevant grammatical form of words.
2. Writing extended definitions Speaking - role play activities, discussions, extempore speaking exercises speculating about the future.
3. Any other related relevant classroom activity.

UNIT V

'If' conditionals – Gerunds - Intensive reading - Speaking – Presentation of problems & solutions - Itinerary – planning for an industrial visit - Formal Letter writing – Letter to the editor, invitation letter, accepting, declining letter and permission letter.

Suggested activities:

1. (a) Sentence completion exercises using 'If' conditionals.
(b) Gap filling exercises using gerunds and present participle forms
2. Reading comprehension exercises.
3. Role play, discussion, debating and speaking activities for stating, discussing problems and suggesting solutions.
4. Planning a tour, Writing a travel itinerary. Writing letters to officials and to the editor in formal/official contexts.
5. Any other related relevant classroom activity

TEXT BOOK:

1. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 1 – 4 (Resources, Energy, Computer, Transport)

REFERENCES:

1. Meenakshi Raman and Sangeeta Sharma, 'Technical Communication English skills for Engineers', Oxford University Press, 2008.
2. Andrea, J. Rutherford, 'Basic Communication Skills for Technology', Second Edition, Pearson Education, 2007.
- 3.

Extensive Reading:

A.P.J. Abdul Kalam with Arun Tiwari, 'Wings of Fire' An Autobiography, University Press (India) Pvt. Ltd., 1999, 30th Impression 2007.

NOTE:

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

113MAT02 - MATHEMATICS – I

OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II SEQUENCES AND SERIES

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series – Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

UNIT III APPLICATIONS OF DIFFERENTIAL CALCULUS

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES

Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V MULTIPLE INTEGRALS

Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals – Volume of Solids.

TEXT BOOKS:

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., (2011).
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, (2011).

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma, " Higher Engineering Mathematics", S. Chand Private Ltd., (2011).
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, (2012).
3. Peter V. O'Neil, " Advanced Engineering Mathematics", 7th Edition, Cengage learning, (2012).
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2008).

113PHT03 – ENGINEERING PHYSICS I

OBJECTIVE:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I CRYSTAL PHYSICS

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity- Hooke's law - Relationship between three moduli of elasticity (qualitative) – stress - strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders
Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel)

UNIT III QUANTUM PHYSICS

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment -Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonic by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

UNIT V PHOTONICS AND FIBRE OPTICS

Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO₂ , Semiconductor lasers (homojunction & heterojunction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Arumugam M. Engineering Physics. Anuradha publishers, 2010
2. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Mani P. Engineering Physics I. Dhanam Publications, 2011
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
6. Senthilkumar G. Engineering Physics I. VRB Publishers, 2011

113CYT04 - ENGINEERING CHEMISTRY –I

UNIT I POLYMER CHEMISTRY

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: T_g, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

UNIT II CHEMICAL THERMODYNAMICS

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs- Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY

Photochemistry: Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert- Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

UNIT IV PHASE RULE AND ALLOYS

Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

UNIT V NANOCHEMISTRY

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laserablation; Properties and applications.

TEXT BOOKS

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

REFERENCES

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and JayadevSreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

113CPT05 - COMPUTER PROGRAMMING

UNIT I INTRODUCTION

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS

Problem formulation – Problem Solving - Introduction to 'C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V STRUCTURES AND UNIONS

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TEXTBOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

REFERENCES:

1. Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

113EGT06 - ENGINEERING GRAPHICS

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

COMPUTER AIDED DRAFTING (Demonstration Only)

Introduction to drafting packages and demonstration of their use.

TEXT BOOK:

- Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.

REFERENCES:

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
5. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

Practical

113CLP01 - COMPUTER PRACTICE LABORATORY – I

LIST OF EXERCISES

LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

113ELP02 ENGINEERING PRACTICES LABORATORY

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL) I CIVIL ENGINEERING PRACTICE

Buildings: (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

(b) Study of pipe connections requirements for pumps and turbines.

(c) Preparation of plumbing line sketches for water supply and sewage works.

(d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

(a) Study of the joints in roofs, doors, windows and furniture.

(b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE

Welding:

(a) Preparation of arc welding of butt joints, lap joints and tee joints.

(b) Gas welding practice

Basic Machining:

(a) Simple Turning and Taper turning

(b) Drilling Practice

Sheet Metal Work:

(a) Forming & Bending:

(b) Model making – Trays, funnels, etc.

(c) Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump

(b) Study of air conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.

(b) Foundry operations like mould preparation for gear and step cone pulley.

(c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS) III ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE

- 1.** Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
- 2.** Study of logic gates AND, OR, EOR and NOT.
- 3.** Generation of Clock Signal.
- 4.** Soldering practice – Components Devices and Circuits – Using general purpose PCB.
- 5.** Measurement of ripple factor of HWR and FWR.

REFERENCES:

- 1.** Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, (2007).
- 2.** Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Publishing House Pvt.Ltd, (2006)
- 3.** Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, (2007).
- 4.** Rajendra Prasad A. & Sarma P.M.M.S., "Workshop Practice", Sree Sai Publication, (2002).
- 5.** Kannaiah P. & Narayana K.L., "Manual on Workshop Practice", Scitech Publications, (1999).

113PCP03- PHYSICS AND CHEMISTRY LABORATORY – I

PHYSICS LABORATORY – I

LIST OF EXPERIMENTS (Any Five Experiments)

1. (a) Determination of Wavelength, and particle size using Laser
(b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of Young's modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

CHEMISTRY LABORATORY-I

LIST OF EXPERIMENTS (Any Five Experiments)

1. Determination of DO content of water sample by Winkler's method.
2. Determination of chloride content of water sample by argentometric method
3. Determination of strength of given hydrochloric acid using pH meter
4. Determination of strength of acids in a mixture using conductivity meter
5. Estimation of iron content of the water sample using spectrophotometer (1,10- phenanthroline / thiocyanate method)
6. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer
7. Conductometric titration of strong acid vs strong base

REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New Yor (2001).
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore (1994).
3. Jeffery G.H., Bassett J., Mendham J.and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

II Semester

213EHT01 - TECHNICAL ENGLISH II

OBJECTIVES:

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

OUTCOMES:

Learners should be able to speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies. write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing. read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation. listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

UNIT I

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emojicons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary - blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

UNIT III

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information - expressing feelings (affection, anger, regret, etc.); Reading - Speed reading - reading passages with time limit - Skimming; Writing - Minutes of meeting - format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles - elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials - Attending a meeting and writing minutes.

UNIT IV

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; Materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

TEXTBOOKS

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

REFERENCES

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, MasonUSA. 2007

EXTENSIVE Reading (Not for Examination)

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

Websites

1. <http://www.englishclub.com>
2. <http://owl.english.purdue.edu>

TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

EVALUATION PATTERN:

Internal assessment: 20%

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report
- Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.

- Speaking assessment: Individual presentations, Group discussions
- Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

End Semester Examination: 80%

OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III LAPLACE TRANSFORM

Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV ANALYTIC FUNCTIONS

Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: $w = z+k$, kz , $1/z$, z^2 , ez and bilinear transformation.

UNIT V COMPLEX INTEGRATION

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

TEXT BOOKS:

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, LaxmiPublications Pvt Ltd.,(2011).
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi,(2011).

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma, " Higher Engineering Mathematics", S. Chand Private Ltd., (2011)
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, (2012).
3. Peter V. O'Neil, " Advanced Engineering Mathematics", 7th Edition, Cengage learning, (2012).
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2008).

213PHT03 ENGINEERING PHYSICS – II

OBJECTIVES:

- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I CONDUCTING MATERIALS

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors – direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration -- Hall effect – Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity (Qualitative) - High T_c superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials – Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

REFERENCES:

1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011
2. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011
3. Mani P. Engineering Physics II. Dhanam Publications, 2011
4. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009

UNIT I WATER TECHNOLOGY

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement-boiler corrosion-priming and foaming- desalination of brackish water -reverse osmosis.

UNIT II ELECTROCHEMISTRY AND CORROSION

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types-chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection - sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

UNIT III ENERGY SOURCES

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- nickel- cadmium battery- lithium battery- fuel cell H₂ -O₂ fuel cell- applications.

UNIT IV ENGINEERING MATERIALS

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties - refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement-properties and uses. Glass - manufacture, types, properties and uses.

UNIT V FUELS AND COMBUSTION

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (OttoHoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking- octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio ignition temperature- explosive range - flue gas analysis (ORSAT Method).

TEXT BOOKS

1. Vairam S, Kalyani P and SubaRamesh., "Engineering Chemistry"., Wiley India Pvt Ltd., New Delhi., 2011
2. Dara S.S, Umare S.S. "Engineering Chemistry", S. Chand & Company Ltd., New Delhi , 2010

REFERENCES

1. Kannan P. and Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009
2. Ashima Srivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
3. Renu Bapna and Renu Gupta., "Engineering Chemistry", Macmillan India Publisher Ltd., 2010.
4. 4 Pahari A and Chauhan B., "Engineering Chemistry"., Firewall Media., New Delhi., 2010

A – CIVIL ENGINEERING

UNIT I - SURVEYING AND CIVIL ENGINEERING MATERIALS

Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II - BUILDING COMPONENTS AND STRUCTURES

Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

B – MECHANICAL ENGINEERING

UNIT III - POWER PLANT ENGINEERING

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV - IC ENGINES

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V - REFRIGERATION AND AIR CONDITIONING SYSTEM

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

REFERENCES:

1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. (1999).
3. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, (2005).
4. Venugopal K. and Prahua Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2000).

213CTT06 CIRCUIT THEORY

UNIT I BASIC CIRCUITS ANALYSIS

Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power, Power Factor and Energy.

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III RESONANCE AND COUPLED CIRCUITS

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input – Characterization of two port networks in terms of Z,Y and h parameters.

UNIT V THREE PHASE CIRCUITS

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & unbalanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, 2003.
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi, 2001.

REFERENCES:

1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, (2007).
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

Practical

213PCP01 - PHYSICS AND CHEMISTRY LABORATORY - II

PHYSICS LABORATORY - II (Any FIVE Experiments)

1. Determination of Young's modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid -Poiseuille's method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire - Air wedge method
6. Determination of Rigidity modulus - Torsion pendulum

CHEMISTRY LABORATORY -II (Any FIVE Experiments)

1. Determination of alkalinity in water sample
2. Determination of total, temporary & permanent hardness of water by EDTA method
3. Estimation of copper content of the given solution by EDTA method
4. Estimation of iron content of the given solution using potentiometer
5. Estimation of sodium present in water using flame photometer
6. Corrosion experiment - weight loss method
7. Conductometric precipitation titration using BaCl_2 and Na_2SO_4
8. Determination of CaO in Cement.

REFERENCES:

1. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York (2001).
 2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore (1994).
 3. Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
 4. Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, Mcmillan, Madras 1980.
- **Laboratory classes on alternate weeks for Physics and Chemistry.**

213CPP02 - COMPUTER PROGRAMMING LABORATORY

LIST OF EXPERIMENTS

1. UNIX COMMANDS

Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING

Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX

Dynamic Storage Allocation-Pointers-Functions-File Handling

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

- 1 UNIX Clone Server
- 33 Nodes (thin client or PCs)
- Printer – 3 Nos.

Software

- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

213ELP03 - ELECTRIC CIRCUITS LABORATORY

LIST OF EXPERIMENTS

1. Experimental verification of Kirchhoff's voltage and current laws
2. Experimental verification of network theorems (Thevenin, Norton, Superposition and maximum power transfer Theorem).
3. Study of CRO and measurement of sinusoidal voltage, frequency and power factor.
4. Experimental determination of time constant of series R-C electric circuits.
5. Experimental determination of frequency response of RLC circuits.
6. Design and Simulation of series resonance circuit.
7. Design and Simulation of parallel resonant circuits.
8. Simulation of low pass and high pass passive filters.
9. Simulation of three phase balanced and unbalanced star, delta networks circuits.
10. Experimental determination of power in three phase circuits by two-watt meter method.
11. Calibration of single phase energy meter.
12. Determination of two port network parameters.

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS

1. Regulated Power Supply: 0 – 15 V D.C - 10 Nos / Distributed Power Source.
2. Function Generator (1 MHz) - 10 Nos.
3. Single Phase Energy Meter - 1 No.
4. Oscilloscope (20 MHz) - 10 Nos.
5. Digital Storage Oscilloscope (20 MHz) – 1 No.
6. Circuit Simulation Software (5 Users) (Pspice / Matlab /other Equivalent software Package) with PC(5 Nos.) and Printer (1 No.)
7. AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.)
8. Single Phase Wattmeter – 3 Nos.
9. Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box Each - 6 Nos.
10. Circuit Connection Boards - 10 Nos.

Necessary Quantities of Resistors, Inductors, Capacitors of various capacities (Quarter Watt to 10 Watt)

III Semester

313MAT01 - TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

OBJECTIVES:

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV FOURIER TRANSFORMS

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS

Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

OUTCOMES:

- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOKS:

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

REFERENCES:

1. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.
2. Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Datta K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

313EET02 - DIGITAL LOGIC CIRCUITS

OBJECTIVES:

- To study various number systems , simplify the logical expressions using Boolean functions
- To study implementation of combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLCs
- To introduce digital simulation for development of application oriented logic circuits.

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code)- Digital Logic Families ,comparison of RTL, DTL, TTL, ECL and MOS families - operation, characteristics of digital logic family.

UNIT II COMBINATIONAL CIRCUITS

Combinational logic - representation of logic functions-SOP and POS forms, K-map representations-minimization using K maps - simplification and implementation of combinational logic – multiplexers and demultiplexers - code converters, adders, subtractors.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES

Asynchronous sequential logic circuits-Transition table, flow table-race conditions, hazards & errors in digital circuits; analysis of asynchronous sequential logic circuits-introduction to Programmable Logic Devices: PROM – PLA –PAL.

UNIT V VHDL

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flipflops, FSM, Multiplexers /Demultiplexers).

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. Raj Kamal, ' Digital systems-Principles and Design', Pearson Education 2nd edition, 2007.
2. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education,2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

REFERENCES:

1. Mandal "Digital Electronics Principles & Application, McGraw Hill Edu,2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL,Pearson,2013.
3. Floyd and Jain, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
4. Anand Kumar, Fundamentals of Digital Circuits,PHI,2013.
5. Charles H.Roth,Jr,Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.
6. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 2002.
7. Gaganpreet Kaur, VHDL Basics to Programming, Pearson, 2013.
8. Botros, HDL Programming Fundamental, VHDL& Verilog, Cengage, 2013.

313EET03 - ELECTROMAGNETIC THEORY

OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations
- To impart knowledge on the concepts of Concepts of electromagnetic waves and Pointing vector.

UNIT I ELECTROSTATICS – I

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields – Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT II ELECTROSTATICS – II

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization - Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT III MAGNETOSTATICS

Lorentz force, magnetic field intensity (H) – Biot-Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT IV ELECTRODYNAMIC FIELDS

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

UNIT V ELECTROMAGNETIC WAVES

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction – Standing Wave – Applications.

OUTCOMES:

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

TEXT BOOKS:

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 4 th Edition ,Oxford University Press Inc. First India edition, 2009.
2. Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', PHI Learning Private Limited, New Delhi, Second Edition-2009.
3. K.A. Gangadhar, P.M. Ramanathan ` Electromagnetic Field Theory (including Antennas and wave propagation', 16th Edition, Khanna Publications, 2007.

REFERENCES:

1. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), Tata McGraw Hill, 2010
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill 8th Revised edition, 2011.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.
4. Bhag Singh Guru and Hüseyin R. Hiziroglu "Electromagnetic field theory Fundamentals", Cambridge University Press; Second Revised Edition, 2009.

313EET04 - ENVIRONMENTAL SCIENCE AND ENGINEERING

OBJECTIVES:

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO₂, NO_x, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS :

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCES :

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
5. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.

313EET05 - ELECTRONIC DEVICES AND CIRCUITS

OBJECTIVES:

The student should be made to:

- Be familiar with the structure of basic electronic devices.
- Be exposed to the operation and applications of electronic devices.

UNIT I PN JUNCTION DEVICES

PN junction diode –structure, operation and V-I characteristics, diffusion and transient capacitance
- Rectifiers – Half Wave and Full Wave Rectifier, – Display devices- LED, Laser diodes- Zener diode characteristics-Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristor and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

OUTCOMES:

- To explain the structure of the basic electronic devices.
- To design applications using the basic electronic devices.

TEXT BOOKS:

1. David A. Bell , "Electronic Devices and Circuits", Prentice Hall of India, 2004.
2. Sedra and smith, "Microelectronic Circuits " Oxford University Press, 2004.

REFERENCES:

1. Rashid, "Micro Electronic Circuits" Thomson publications, 1999.
2. Floyd, "Electron Devices" Pearson Asia 5th Edition, 2001.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic Devices and Circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.

313EET06 - LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

OBJECTIVES:

- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like Timers, PLL
- circuits, regulator Circuits, ADCs.

UNIT I IC FABRICATION

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs.

UNIT II CHARACTERISTICS OF OPAMP

Ideal OP-AMP characteristics, DC characteristics, AC characteristics,, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers-V/I & I/V converters ,summer, differentiator and integrator.

UNIT III APPLICATIONS OF OPAMP

Instrumentation amplifier, Log and Antilog Amplifiers, first and second order active filters, , comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV SPECIAL ICs

Functional block, characteristics & application circuits with 555 Timer Ic-566 voltage controlled oscillator Ic; 565-phase lock loop Ic ,Analog multiplier ICs.

UNIT V APPLICATION ICs

IC voltage regulators –LM78XX,79XX Fixed voltage regulators - LM317, 723 Variable voltage regulators, switching regulator- SMPS- LM 380 power amplifier- ICL 8038 function generator IC.

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. David A.Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCES:

1. Fiore,"Opamps & Linear Integrated Circuits Concepts & Applications",Cengage,2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system',Tata McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, 6th edition,2012.

Practical

313EEP01 - ELECTRONICS LABORATORY

OBJECTIVES:

To enable the students to understand the behavior of semiconductor device based on Experimentation

LIST OF EXPERIMENTS:

1. Characteristics of Semi conductor diode and Zener diode
2. Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
3. Characteristics of JFET(Draw the equivalent circuit)
4. Characteristics of UJT and generation of saw tooth waveforms
5. Design and Frequency response characteristics of a Common Emitter amplifier
7. Characteristics of photo diode & photo transistor, Study of light activated relay circuit
8. Design and testing of RC phase shift, LC oscillators
9. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
10. Differential amplifiers using FET
11. Study of CRO for frequency and phase measurements
12. Astable and Monostable multivibrators
13. Realization of passive filters

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- 1.Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC 8
4. Function Generators 10
5. Regulated 3 output Power Supply 5, \pm 15V 10
6. CRO 10
7. Storage Oscilloscope 1
8. Bread boards 10
9. Atleast one demo module each for the listed equipments.
10. Component data sheets to be provided

313EEP02 - LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY

OBJECTIVES:

Working Practice in simulators / CAD Tools / Experiment test bench to learn design, testing and characterizing of circuit behaviour with digital and analog ICs.

LIST OF EXPERIMENTS:

1. Implementation of Boolean Functions, Adder/ Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders
5. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
7. Study of multiplexer and demultiplexer
- 8 Timer IC application: Study of NE/SE 555 timer in Astable, Monostable operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Study of VCO and PLL ICs:
 - i. Voltage to frequency characteristics of NE/ SE 566 IC.
 - ii. Frequency multiplication using NE/SE 565 PLL IC.

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

(3 per Batch)

S.No Name of the equipments / Components Quantity Required Remarks

- 1 Dual ,(0-30V) variable Power Supply 10 -
- 2 CRO 9 30MHz
- 3 Digital Multimeter 10 Digital
- 4 Function Generator 8 1 MHz
- 5 IC Tester (Analog) 2
- 6 Bread board 10
- 7 Computer (PSPICE installed) 1

Consumables (Minimum of 25 Nos. each)

- 1 IC 741/ IC NE555/566/565 25
- 2 Digital IC types 25
- 3 LED 25
- 4 LM317 25
- 5 LM723 25
- 6 ICSG3524 / SG3525 25
- 7 Transistor – 2N3391 25
- 8 Diodes, 25 IN4001,BY126
- 9 Zener diodes 25
- 10 Potentiometer
- 11 Step-down transformer 1 230V/12-0-12V
- 12 Capacitor
- 13 Resistors 1/4 Watt Assorted 25
- 14 Single Strand Wire

IV Semester

413EET01 - NUMERICAL METHODS

OBJECTIVES:

□ This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

UNIT II INTERPOLATION AND APPROXIMATION

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

Single Step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bashforth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

OUTCOMES:

□ The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:

1. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi, 2007.
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.

REFERENCES:

1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5th Edition, New Delhi, 2007.
2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.
3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3rd Edition, New Delhi, 2007.

OBJECTIVES:

- To introduce techniques of magnetic-circuit analysis and introduce magnetic materials
- To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
- To study the working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
- To study the working principles of DC machines as Generator types, determination of their no-load/ load characteristics, starting and methods of speed control of motors.
- To estimate the various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance.

UNIT I MAGNETIC CIRCUITS AND MAGNETIC MATERIALS

Magnetic circuits – Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets-Transformer as a magnetically coupled circuit.

UNIT II TRANSFORMERS

Construction – principle of operation – equivalent circuit parameters – phasor diagrams, losses – testing – efficiency and voltage regulation-all day efficiency-Sumpner's test, per unit representation – inrush current - three phase transformers-connections – Scott Connection – Phasing of transformer– parallel operation of three phase transformers-auto transformer – tap changing transformers- tertiary winding.

UNIT III ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES

Energy in magnetic system – Field energy and coenergy-force and torque equations – singly and multiply excited magnetic field systems-mmF of distributed windings – Winding Inductances-, magnetic fields in rotating machines – rotating mmF waves – magnetic saturation and leakage fluxes.

UNIT IV DC GENERATORS

Construction and components of DC Machine – Principle of operation - Lap and wave windings-EMF equations– circuit model – armature reaction – methods of excitation-commutation and interpoles - compensating winding – characteristics of DC generators.

UNIT V DC MOTORS

Principle and operations - types of DC Motors – Speed Torque Characteristics of DC Motors-starting and speed control of DC motors – Plugging, dynamic and regenerative braking- testing and efficiency – Retardation test- Swinburne's test and Hopkinson's test - Permanent magnet dc motors(PMDC)-DC Motor applications.

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. Nagrath I. J and Kothari D. P. 'Electric Machines', Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2010.
2. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
3. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, Tata McGraw Hill Books Company, 2003.

REFERENCES:

1. P. C. Sen., 'Principles of Electrical Machines and Power Electronics', John Wiley & Sons, 1997.
2. Syed A. Nasar, Electric Machines and Power Systems: Volume I, McGraw-Hill College; International Edition, January 1995.
3. Deshpande M. V., "Electrical Machines" PHI Learning Pvt. Ltd., New Delhi, 2011.
4. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, 2003.
5. S.Sarma & K.Pathak "Electric Machines", Cengage Learning India (P) Ltd., Delhi, 2011.

413EET03 - OBJECT ORIENTED PROGRAMMING

OBJECTIVES:

- To get a clear understanding of object-oriented concepts.
- To understand object oriented programming through C++.

UNIT I OVERVIEW

Why Object-Oriented Programming in C++ - Native Types and Statements -Functions and Pointers- Implementing ADTs in the Base Language.

UNIT II BASIC CHARACTERISTICS OF OOP

Data Hiding and Member Functions- Object Creation and Destruction- Polymorphism data abstraction: Iterators and Containers.

UNIT III ADVANCED PROGRAMMING

Templates, Generic Programming, and STL-Inheritance-Exceptions-OOP Using C++.

UNIT IV OVERVIEW OF JAVA

Data types, variables and arrays, operators, control statements, classes, objects, methods - Inheritance

UNIT V EXCEPTION HANDLING

Packages and Interfaces, Exception handling, Multithreaded programming, Strings, Input/Output

OUTCOMES:

- Gain the basic knowledge on Object Oriented concepts.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems.

TEXT BOOKS:

1. Ira Pohl, "Object-Oriented Programming Using C++", Pearson Education Asia, 2003.
2. H.M.Deitel, P.J.Deitel, "Java : how to program", Fifth edition, Prentice Hall of India private limited, 2003.

REFERENCES:

1. Herbert Schildt, "The Java 2: Complete Reference", Fourth edition, TMH, 2002
2. Bjarne Stroustrup, "The C++ Programming Language", Pearson Education, 2004.
3. Stanley B. Lippman and Josee Lajoie , "C++ Primer", Pearson Education, 2003.
4. K.R.Venugopal, Rajkumar Buyya, T.Ravishankar, "Mastering C++", TMH, 2003.

413EET04 - TRANSMISSION AND DISTRIBUTION

OBJECTIVES:

- To develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuits for the transmission lines based on distance and operating voltage for determining voltage regulation and efficiency. Also to improve the voltage profile of the transmission system.
- To analyse the voltage distribution in insulator strings and cables and methods to improve the same.
- To understand the operation of the different distribution schemes.

UNIT I STRUCTURE OF POWER SYSTEM

Structure of electric power system: generation, transmission and distribution; Types of AC and DC distributors – distributed and concentrated loads – interconnection – EHVAC and HVDC transmission - Introduction to FACTS.

UNIT II TRANSMISSION LINE PARAMETERS

Parameters of single and three phase transmission lines with single and double circuits - Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - application of self and mutual GMD; skin and proximity effects - interference with neighboring communication circuits - Typical configurations, conductor types and electrical parameters of EHV lines, corona discharges.

UNIT III MODELLING AND PERFORMANCE OF TRANSMISSION LINES

Classification of lines - short line, medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation, real and reactive power flow in lines, Power - circle diagrams, surge impedance loading, methods of voltage control; Ferranti effect.

UNIT IV INSULATORS AND CABLES

Insulators - Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators. Underground cables - Types of cables, Capacitance of Single-core cable, Grading of cables, Power factor and heating of cables, Capacitance of 3- core belted cable, D.C cables.

UNIT V MECHANICAL DESIGN OF LINES AND GROUNDING

Mechanical design of transmission line – sag and tension calculations for different weather conditions, Tower spotting, Types of towers, Substation Layout (AIS, GIS), Methods of grounding.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. D.P.Kothari , I.J. Nagarath, 'Power System Engineering', Tata McGraw-Hill Publishing Company limited, New Delhi, Second Edition, 2008.
2. C.L.Wadhwa, 'Electrical Power Systems', New Academic Science Ltd, 2009.
3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2011.

REFERENCES:

1. B.R.Gupta, , S.Chand, 'Power System Analysis and Design'New Delhi, Fifth Edition, 2008.
2. Luces M.Fualken berry ,Walter Coffey, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
3. Hadi Saadat, 'Power System Analysis,' PSA Publishing; Third Edition, 2010.
4. J.Brian, Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2012.
5. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.

413EET05 - DISCRETE TIME SYSTEMS AND SIGNAL PROCESSING

OBJECTIVES:

- To classify signals and systems & their mathematical representation.
- To analyse the discrete time systems.
- To study various transformation techniques & their computation.
- To study about filters and their design for digital implementation.
- To study about a programmable digital signal processor & quantization effects.

UNIT I INTRODUCTION

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT II DISCRETE TIME SYSTEM ANALYSIS

Z-transform and its properties, inverse z-transforms; difference equation – Solution by ztransform, application to discrete systems - Stability analysis, frequency response – Convolution – Discrete Time Fourier transform , magnitude and phase representation.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF using radix 2 FFT – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation - mWarping, pre warping.

UNIT V DIGITAL SIGNAL PROCESSORS

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DSProcessors.

OUTCOMES:

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2003.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.
3. Robert Schilling & Sandra L.Harris, 'Introduction to Digital Signal Processing using Matlab', Cengage Learning, 2014.

REFERENCES:

1. Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH,2013.
2. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010
3. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009.
4. Sen M.kuo, woonseng...s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson,2013
5. Dimitris G.Manolakis, Vinay K. Ingle, applied Digital Signal Processing,Cambridge,2012
6. Lonnie C.Ludeman , "Fundamentals of Digital Signal Processing",Wiley,2013

413EET06 - MEASUREMENTS AND INSTRUMENTATION

OBJECTIVES:

- To introduce the basic functional elements of instrumentation
- To introduce the fundamentals of electrical and electronic instruments
- To educate on the comparison between various measurement techniques
- To introduce various storage and display devices
- To introduce various transducers and the data acquisition systems

UNIT I INTRODUCTION

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS

Principle and types of analog and digital voltmeters, ammeters, multimeters – Single and three phase wattmeters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III COMPARISON METHODS OF MEASUREMENTS

D.C & A.C potentiometers, D.C & A.C bridges, transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – A/D, D/A converters – Smart sensors.

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2003.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2007.

REFERENCES:

1. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, II Edition 2004.
2. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2007.
3. A.J. Bouwens, 'Digital Instrumentation', Tata McGraw Hill, 1997.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

Practical

413EEP01 - OBJECT ORIENTED PROGRAMMING LABORATORY

OBJECTIVES:

- To get a clear understanding of object-oriented concepts.
- To understand object oriented programming through C++ & JAVA.

LIST OF EXPERIMENTS:

C++:

1. program using functions
 - functions with default arguments
 - implementation of call by value, address, reference
2. simple classes for understanding objects, member functions & constructors
 - classes with primitive data members,
 - classes with arrays as data members
 - classes with pointers as data members
 - classes with constant data members
 - classes with static member functions
3. compile time polymorphism
 - operator overloading
 - function overloading
4. run time polymorphism
 - inheritance
 - virtual functions
 - virtual base classes
 - templates
5. file handling
 - sequential access
 - random access

JAVA:

6. simple java applications
 - for understanding references to an instant of a class
 - handling strings in JAVA
7. simple package creation
 - developing user defined packages in java
8. interfaces
 - developing user defined interfaces
 - use predefined interfaces
9. threading
 - creation of threading in java applications
 - multi threading
10. exception handling mechanism in java
 - handling predefined exceptions
 - handling user defined exceptions

OUTCOMES:

- Gain the basic knowledge on Object Oriented concepts.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C++ compiler 30 Nos.

(or)

Server with C++ compiler supporting 30 terminals or more.

413EEP02 - ELECTRICAL MACHINES LABORATORY – I

OBJECTIVES :

To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

LIST OF EXPERIMENTS:

1. Open circuit and load characteristics of DC shunt generator- critical resistance and critical speed.
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load test on DC shunt and compound motor.
4. Load test on DC series motor.
5. Swinburne's test and speed control of DC shunt motor.
6. Hopkinson's test on DC motor – generator set.
7. Load test on single-phase transformer and three phase transformers.
8. Open circuit and short circuit tests on single phase transformer.
9. Polarity Test and Sumpner's test on single phase transformers.
10. Separation of no-load losses in single phase transformer.
11. Study of starters and 3-phase transformers connections

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. DC Shunt Motor Coupled With Three phase Alternator – 1 No.
3. Single Phase Transformer – 4 nos
4. DC Series Motor with Loading Arrangement – 1 No.
5. DC compound Motor with Loading Arrangement – 1 No.
6. Three Phase Induction Motor with Loading Arrangement – 2 nos
7. Single Phase Induction Motor with Loading Arrangement – 1 No.
8. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
9. DC Shunt Motor Coupled With DC Shunt Motor – 1 No.
10. Tachometer -Digital/Analog – 8 nos
11. Single Phase Auto Transformer – 2 nos
12. Three Phase Auto Transformer – 1 No.
13. Single Phase Resistive Loading Bank – 2 nos
14. Three Phase Resistive Loading Bank. – 2 nos
15. SPST switch – 2 nos

V Semester

513EET01 - POWER SYSTEM ANALYSIS

OBJECTIVES:

- To model the power system under steady state operating condition.
- To apply numerical methods to solve the power flow problem.
- To model and analyze the system under faulted conditions.
- To model and analyze the transient behaviour of power system when it is subjected to
- a fault.

UNIT I INTRODUCTION

Need for system planning and operational studies – basic components of a power system.-
Introduction to restructuring - Single line diagram – per phase and per unit analysis – Generator -
transformer – transmission line and load representation for different power system studies.-
Primitive network - construction of Y-bus using inspection and singular transformation methods –
z-bus.

UNIT II POWER FLOW ANALYSIS

Importance of power flow analysis in planning and operation of power systems - statement of
power flow problem - classification of buses - development of power flow model in complex
variables form - iterative solution using Gauss-Seidel method - Q-limit check for voltage
controlled buses – power flow model in polar form - iterative solution using Newton-Raphson
method .

UNIT III FAULT ANALYSIS – BALANCED FAULTS

Importance of short circuit analysis - assumptions in fault analysis - analysis using Thevenin's
theorem - Z-bus building algorithm - fault analysis using Z-bus – computations of short circuit
capacity, post fault voltage and currents.

UNIT IV FAULT ANALYSIS – UNBALANCED FAULTS

Introduction to symmetrical components – sequence impedances – sequence circuits of
synchronous machine, transformer and transmission lines - sequence networks analysis of single
line to ground, line to line and double line to ground faults using Thevenin's theorem and Z-bus
matrix.

UNIT V STABILITY ANALYSIS

Importance of stability analysis in power system planning and operation - classification of power
system stability - angle and voltage stability – Single Machine Infinite Bus (SMIB) system:
Development of swing equation - equal area criterion - determination of critical clearing angle and
time – solution of swing equation by modified Euler method and Runge-Kutta fourth order
method.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011.
2. John J. Grainger and W.D. Stevenson Jr., 'Power System Analysis', Tata McGraw-Hill, Sixth reprint, 2010.
3. P. Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan, 'Electrical Power Systems- Analysis, Security and Deregulation', PHI Learning Private Limited, New Delhi, 2012.

REFERENCES:

1. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
2. Kundur P., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
3. Pai M A, 'Computer Techniques in Power System Analysis', Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007.
4. J. Duncan Glover, Mulukutla S. Sarma, Thomas J. Overbye, 'Power System Analysis & Design', Cengage Learning, Fifth Edition, 2012.
5. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Limited, New Delhi, Second Edition, 2012.
6. C.A.Gross, "Power System Analysis," Wiley India, 2011.

513EET02 - MICROPROCESSORS AND MICROCONTROLLERS

OBJECTIVES:

- To study the Architecture of uP8085 & uC 8051
- To study the addressing modes & instruction set of 8085 & 8051.
- To introduce the need & use of Interrupt structure 8085 & 8051.
- To develop skill in simple applications development with programming 8085 & 8051
- To introduce commonly used peripheral / interfacing

UNIT I 8085 PROCESSOR

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts-Comparison to Programming concepts with 8085.

UNIT IV PERIPHERAL INTERFACING

Study on need, Architecture, configuration and interfacing, with ICs: 8255 , 8259 , 8254,8237,8251, 8279 , - A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Data Transfer, Manipulation, Control Algorithms& I/O instructions – Simple programming exerciseskey board and display interface – Closed loop control of servo motor- stepper motor control – Washing Machine Control.

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.
- To understand and apply computing platform and software for engineering problems.

TEXT BOOKS:

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi , 2007.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.

REFERENCES:

1. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
2. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, 'Microprocessors and Microcontrollers', Oxford,2013.
3. Valder – Perez, "Microcontroller – Fundamentals and Applications with Pic," Yeesdee Publishers, Tayler & Francis, 2013.

513EET03 - POWER PLANT ENGINEERING

OBJECTIVES:

Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor (BWR)*, *Pressurized Water Reactor (PWR)*, CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

OUTCOMES:

- Upon completion of this course, the Students can able to understand different types of power plant, and its functions and their flow lines and issues related to them.
- Analyse and solve energy and economic related issues in power sectors.

TEXT BOOK:

1. P.K. Nag, Power Plant Engineering, Tata McGraw – Hill Publishing Company Ltd., Third Edition, 2008.

REFERENCES:

1. M.M. El-Wakil, Power Plant Technology, Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Black & Veatch, Springer, Power Plant Engineering, 1996.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, Standard Handbook of Power Plant Engineering, Second Edition, McGraw – Hill, 1998.
4. Godfrey Boyle, Renewable energy, Open University, Oxford University Press in association with the Open University, 2004.

513EET04 - POWER ELECTRONICS

OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basic topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

UNIT I POWER SEMI-CONDUCTOR DEVICES

Study of switching devices, Diode, SCR, TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggering and commutation circuit for SCR- Design of Driver and snubber circuit.

UNIT II PHASE-CONTROLLED CONVERTERS

2-pulse, 3-pulse and 6-pulse converters – performance parameters – Effect of source inductance – Gate Circuit Schemes for Phase Control – Dual converters.

UNIT III DC TO DC CONVERTER

Step-down and step-up chopper-control strategy – Forced commutated chopper – Voltage commutated, Current commutated, Load commutated, Switched mode regulators- Buck, boost, buck-boost converter, Introduction to Resonant Converters.

UNIT IV INVERTERS

Single phase and three phase voltage source inverters (both 120° mode and 180° mode) – Voltage & harmonic control – PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulation – Current source inverter.

UNIT V AC TO AC CONVERTERS

Single phase and Three phase AC voltage controllers – Control strategy- Power Factor Control – Multistage sequence control - single phase and three phase cyclo converters – Introduction to Matrix converters.

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. M.H.Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third Edition, New Delhi, 2004.
2. P.S.Bimbhra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.

REFERENCES:

1. Joseph Vithayathil, 'Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003.
3. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
4. Ned Mohan, Tore. M. Undel and, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.
5. Daniel.W.Hart, "Power Electronics", Indian Edition, Mc Graw Hill, 3rd Print, 2013.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.

513EET05 - ELECTRICAL MACHINES – II

OBJECTIVES:

- To impart knowledge on Construction and performance of salient and non – salient type synchronous generators.
- To impart knowledge on Principle of operation and performance of synchronous motor.
- To impart knowledge on Construction, principle of operation and performance of induction machines.
- To impart knowledge on Starting and speed control of three-phase induction motors.
- To impart knowledge on Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR

Constructional details – Types of rotors –winding factors- emf equation – Synchronous reactance – Armature reaction – Phasor diagrams of non salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque -Change of excitation and mechanical input- Voltage regulation – EMF, MMF, ZPF and A.S.A methods – steady state powerangle characteristics– Two reaction theory –slip test -short circuit transients - Capability Curves

UNIT II SYNCHRONOUS MOTOR

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

UNIT III THREE PHASE INDUCTION MOTOR

Constructional details – Types of rotors -- Principle of operation – Slip –cogging and crawling-Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Double cage induction motors –Induction generators – Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star-delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Servo motors- Stepper motors - introduction to magnetic levitation systems.

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D.Umans, 'Electric Machinery', Tata Mc Graw Hill publishing Company Ltd, 2003.
2. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.
3. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.

REFERENCES:

1. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
2. Charless A. Gross, "Electric /Machines, "CRC Press, 2010.
3. K. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt. Ltd, 2002.
4. Syed A. Nasar, Electric Machines and Power Systems: Volume I, Mcgraw -Hill College; International ed Edition, January 1995.
5. Alexander S. Langsdorf, Theory of Alternating-Current Machinery, Tata McGraw Hill Publications, 2001.

513EET06 - CONTROL SYSTEMS

OBJECTIVES:

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed-loop frequency responses of systems.
- To introduce stability analysis and design of compensators
- To introduce state variable representation of physical systems and study the effect of state feedback

UNIT I SYSTEMS AND THEIR REPRESENTATION

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis.

UNIT III FREQUENCY RESPONSE

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications- Effect of Lag, lead and lag-lead compensation on frequency response- Analysis.

UNIT IV STABILITY AND COMPENSATOR DESIGN

Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria – Lag, lead and lag-lead networks – Lag/Lead compensator design using bode plots.

UNIT V STATE VARIABLE ANALYSIS

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability – Effect of state feedback.

OUTCOMES:

- Ability to understand and apply basic science, circuit theory, theory control theory Signal processing and apply them to electrical engineering problems.

TEXT BOOKS:

1. M. Gopal, 'Control Systems, Principles and Design', 4th Edition, Tata McGraw Hill, New Delhi, 2012
2. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
3. Dhanesh. N. Manik, Control System, Cengage Learning, 2012.

REFERENCES:

1. Arthur, G.O.Mutambara, Design and Analysis of Control; Systems, CRC Press, 2009.
2. Richard C. Dorf and Robert H. Bishop, " Modern Control Systems", Pearson Prentice Hall, 2012.
3. Benjamin C. Kuo, Automatic Control systems, 7th Edition, PHI, 2010.
4. K. Ogata, 'Modern Control Engineering', 5th edition, PHI, 2012.
5. S.N.Sivanandam, S.N.Deepa, Control System Engineering using Mat Lab, 2nd Edition, Vikas Publishing, 2012.
6. S.Palani, Anoop. K.Jairath, Automatic Control Systems including Mat Lab, Vijay Nicole/ Mcgraw Hill Education, 2013.

Practical

513EEP01 - CONTROL AND INSTRUMENTATION LABORATORY

OBJECTIVES:

To provide knowledge on analysis and design of control system along with basics of instrumentation

LIST OF EXPERIMENTS:

CONTROLSYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modeling of Systems – Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro-Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks –AC and DC Bridges
9. Dynamics of Sensors/Transducers a. Temperature
b. Pressure
c. Displacement
d. Optical
e. Strain f. Flow
10. Power and Energy Measurement
11. Signal Conditioning
a. Instrumentation Amplifier
b. Analog – Digital and Digital –Analog converters (ADC and DACs)
12. Process Simulation.

OUTCOMES:

□ Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CONTROLSYSTEMS:

1. PID kit – 1 No.
DSO – 1 No.
CRO Probe – 2 nos
2. Personal computers
3. DC motor – 1 No.
Generator – 1 No. Rheostats – 2 nos
Ammeters Voltmeters
Connecting wires (3/20)
4. CRO 30MHz – 1 No.
2MHz Function Generator – 1No.
5. Position Control Systems Kit (with manual) – 1 No., Tacho Generator Coupling set
6. AC Synchro transmitter& receiver – 1No.
Digital multi meters

INSTRUMENTATION:

7. R, L, C Bridge kit (with manual)
8. a) Electric heater – 1No.
Thermometer – 1No. Thermistor (silicon type) RTD nickel type – 1No.
b) 30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA)
Air foot pump – 1 No. (with necessary connecting tubes)
- c) LVDT 20mm core length movable type – 1No. CRO 30MHz – 1No.
- d) Optical sensor – 1 No. Light source
- e) Strain Gauge Kit with Handy lever beam – 1No.
100gm weights – 10 nos
- f) Flow measurement Trainer kit – 1 No.
(1/2 HP Motor, Water tank, Digital Milliammeter, complete set)
9. Single phase Auto transformer – 1No.
Watt-hour meter (energy meter) – 1No. Ammeter Voltmeter Rheostat Stop watch Connecting wires (3/20)
10. IC Transistor kit – 1No.

513EEP02 - COMMUNICATION AND SOFT SKILLS LAB

UNIT I : LISTENING/ VIEWING SKILLS :

Listening to lectures, discussions - talk shows - news programmes - interviews – instructions - dialogues – Speeches of different nationalities with focus on American and British accent – Inspiring speeches – telephonic conversations – discussion to answer different kinds of questions – Watching documentaries on personalities, places, socio-cultural events.

UNIT II: SPEAKING SKILLS :

Conversational skills – Interview skills – Making Presentations - Group Discussion – Introducing oneself and others – Role Play – Debate – Panel Discussion – telephonic communication - attending job interviews.

UNIT III: READING SKILLS :

Reading different genres of texts from Newspapers, Literature, Media, Technical – Vocabulary building – speed reading (skimming & scanning) – Reading online sources like e-books, e-journals and e-newspapers – critical reading – Facts and Fiction – Sumarizing & intpretation.

UNIT IV : WRITING SKILLS :

Writing Job applications – cover letter – resume - emails – letters/ Recomendations and Instructions/ Writing for media on current events/ Report Writing/ English for National & International Examination (TOEFL, IELTS, GRE, IAS Language related)

UNIT V : SOFT SKILLS & EMPLOYABILITY SKILLS :

Motivation – Self Image – Goal Setting – Time management – Creative & Critical Thinking – Learning Style & Strategies – Gestures – Eye Contact.

LAB INFRASTRUCTURE

Sl.No.	Description of equipment (Minimum Configuration)	Oty Required
1.	Server	1 No.
	PIV SYSTEM	
	• 1 GB RAM / 40 GB HDD	
	• OS : Win 2000 server	
	• Audio card with Headphones	
2.	Client Systems	60 Nos.
	• PIII System	
	• 256 or 512 MB RAM / 40 GB HDD	
	• OS : Win 2000	
	• Audio Card with headphones	
3.	Handicam	1 No.
	Television 46"	
	Collar Mike	
	Cordless Mike	
	Audio Mixer	
8.	DVD recorder / Player	1 No.
9.	LCD projector with MP3/ CD/ DVD provision for Audio/video facility	1 No.

513EEP03 - ELECTRICAL MACHINES LABORATORY - II

OBJECTIVES:

To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

LIST OF EXPERIMENTS:

1. Regulation of three phase alternator by emf and mmf methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor(Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Synchronous Induction motor 3HP – 1 No.
2. DC Shunt Motor Coupled With Three phase Alternator – 4 nos
3. DC Shunt Motor Coupled With Three phase Slip ring Induction motor – 1 No.
4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 2 nos
6. Tachometer -Digital/Analog – 8 nos
7. BLDC Motor – 1 No.
8. Single Phase Auto Transformer – 2 nos
9. Three Phase Auto Transformer – 3 nos
10. Single Phase Resistive Loading Bank – 2 nos
11. Three Phase Resistive Loading Bank – 2 nos
12. Capacitor Bank – 1 No.
13. SPST switch – 2 nos

VI Semester

613EET01 - COMMUNICATION ENGINEERING

OBJECTIVES:

- To introduce different methods of analog communication and their significance
- To introduce Digital Communication methods for high bit rate transmission
- To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
- To introduce MAC used in communication systems for enhancing the number of users.
- To introduce various media for digital communication

UNIT I ANALOG COMMUNICATION

AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM – frequency spectrum – power relations: NBFM & WBFM, Generation of FM and DM, Amstrong method & Reactance modulations : FM & PM frequency.

UNIT II DIGITAL COMMUNICATION

Pulse modulations – concepts of sampling and sampling theormes, PAM, PWM, PPM, PTM, quantization and coding : DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL (Qualitative only)

Primary communication – entropy, properties, BSC, BEC, source coding : Shaum, Fao, Huffman coding : noiseless coding theorem, BW – SNR trade off codes: NRZ, RZ, AMI, HDBP, ABQ, MBnBcodes : Efficiency of transmissions, error control codes and applications: convolutions & block codes.

UNIT IV MULTIPLE ACCESS TECHNIQUES

SS&MA techniques : FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits) :

UNIT V SATELLITE, OPTICAL FIBER – POWERLINE, SCADA

Orbits : types of satellites : frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat: fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications: SCADA

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. Taub & Schiling "Principles of Communication Systems" Tata McGraw Hill 2007.
2. J.Das "Principles of Digital Communication" New Age International, 1986.

REFERENCES:

1. Kennedy and Davis "Electronic Communication Systems" Tata McGraw hill, 4th Edition, 1993.
2. Sklar "Digital Communication Fundamentals and Applications" Pearson Education, 2001.
3. Bary le, Memuschmidt, Digital Communication, Kluwer Publication, 2004.
4. B.P.Lathi "Modern Digital and Analog Communication Systems" Oxford University Press, 1998.

613EET02 - SOLID STATE DRIVES

OBJECTIVES:

- To understand steady state operation and transient dynamics of a motor load system.
- To study and analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
- To study and understand the operation and performance of AC motor drives.
- To analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

UNIT I DRIVE CHARACTERISTICS

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE

Steady state analysis of the single and three phase converter fed separately excited DC motor drive–continuous and discontinuous conduction– Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive.

UNIT III INDUCTION MOTOR DRIVES

Stator voltage control–energy efficient drive–v/f control–constant airgap flux–field weakening mode – voltage / current fed inverter – closed loop control.

UNIT IV SYNCHRONOUS MOTOR DRIVES

V/f control and self control of synchronous motor: Margin angle control and power factor control – permanent magnet synchronous motor.

UNIT V DESIGN OF CONTROLLERS FOR DRIVES

Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback–armature voltage control and field weakening mode – Design of controllers; current controller and speed controller- converter selection and characteristics.

OUTCOMES:

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

TEXT BOOKS:

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.
3. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Prentice Hall of India, 2001.

REFERENCES:

1. John Hindmarsh and Alasdain Renfrew, "Electrical Machines and Drives System," Elsevier 2012.
2. Shaahin Felizadeh, "Electric Machines and Drives", CRC Press(Taylor and Francis Group), 2013.
3. S.K.Pillai, A First course on Electrical Drives, Wiley Eastern Limited, 1993.
4. S. Sivanagaraju, M. Balasubba Reddy, A. Mallikarjuna Prasad "Power semiconductor drives" PHI, 5th printing, 2013.
5. N.K.De., P.K.SEN"Electric drives" PHI, 2012.
6. Vedam Subramanyam, "Thyristor Control of Electric Drives", Tata McGraw Hill, 2007.

613EET03 - EMBEDDED SYSTEMS

OBJECTIVES:

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in Various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one realtime operating system tool

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS

Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols - RS232 standard – RS422 – RS485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communications shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, 4C/OS-II, RT Linux.

UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT

Case Study of Washing Machine- Automotive Application- Smart card System Application,.

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. Rajkamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013.
2. Peckol, "Embedded system Design", John Wiley & Sons,2010
3. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013

REFERENCES:

1. Shibu. K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill,2009.
2. Elicia White," Making Embedded Systems", O' Reilly Series,SPD,2011.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning,2009.
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

613EET04 - POWER SYSTEM OPERATION AND CONTROL

OBJECTIVES:

- To have an overview of power system operation and control.
- To model power-frequency dynamics and to design power-frequency controller.
- To model reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- To study the economic operation of power system.
- To teach about SCADA and its application for real time operation and control of power systems.

UNIT I INTRODUCTION

An overview of power system operation and control - system load variation - load characteristics - load curves and load-duration curve - load factor - diversity factor - Importance of load forecasting and quadratic and exponential curve fitting techniques of forecasting - plant level and system level controls .

UNIT II REAL POWER - FREQUENCY CONTROL

Basics of speed governing mechanism and modeling - speed-load characteristics - load sharing between two synchronous machines in parallel - control area concept - LFC control of a single-area system - static and dynamic analysis of uncontrolled and controlled cases - two-area system - modeling - static analysis of uncontrolled case - tie line with frequency bias control - state variable model - integration of economic dispatch control with LFC.

UNIT III REACTIVE POWER-VOLTAGE CONTROL

Generation and absorption of reactive power - basics of reactive power control - excitation systems - modeling - static and dynamic analysis - stability compensation - methods of voltage control: tapchanging transformer, SVC (TCR + TSC) and STATCOM - secondary voltage control.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH

Formulation of economic dispatch problem - I/O cost characterization - incremental cost curve - coordination equations without and with loss (No derivation of loss coefficients) - solution by direct method and λ -iteration method - statement of unit commitment problem - priority-list method - forward dynamic programming.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS

Need for computer control of power systems - concept of energy control centre - functions - system monitoring - data acquisition and control - system hardware configuration - SCADA and EMS functions - network topology - state estimation - WLSE - Contingency Analysis - state transition diagram showing various state transitions and control strategies.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.
2. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
3. Abhijit Chakrabarti, Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

REFERENCES:

1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011.
2. Kundur P., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
3. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
4. N.V.Ramana, "Power System Operation and Control," Pearson, 2011.
5. C.A.Gross, "Power System Analysis," Wiley India, 2011.

613EET05 - DESIGN OF ELECTRICAL MACHINES

OBJECTIVES:

- To study mmf calculation and thermal rating of various types of electrical machines.
- To design armature and field systems for D.C. machines.
- To design core, yoke, windings and cooling systems of transformers.
- To design stator and rotor of induction machines.
- To design stator and rotor of synchronous machines and study their thermal behaviour.

UNIT I INTRODUCTION

Major considerations in Electrical Machine Design - Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Heat flow – Temperature rise and Insulating Materials - Rating of machines – Standard specifications.

UNIT II DC MACHINES

Output Equations – Main Dimensions – Choice of Specific Electric and Magnetic Loading – Magnetic Circuits Calculations - Carter's Coefficient - Net length of Iron – Real & Apparent flux densities – Selection of number of poles – Design of Armature – Design of commutator and brushes – performance prediction using design values.

UNIT III TRANSFORMERS

Output Equations – Main Dimensions - kVA output for single and three phase transformers – Window space factor – Design of core and winding – Overall dimensions – Operating characteristics – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.

UNIT IV INDUCTION MOTORS

Output equation of Induction motor – Main dimensions – Choice of Average flux density – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor – Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current - Short circuit current – Operating characteristics- Losses and Efficiency.

UNIT V SYNCHRONOUS MACHINES

Output equations – choice of Electrical and Magnetic Loading – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor – Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.
2. M.V.Deshpande "Design and Testing of Electrical Machine Design" Wheeler Publications, 2010.

REFERENCES:

1. A.Shanmuga Sundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint, 2007.
2. R.K.Agarwal " Principles of Electrical Machine Design" Esskay Publications, Delhi, 2002.
3. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

Practical

613EEP01 POWER ELECTRONICS AND DRIVES LABORATORY

OBJECTIVES:

To provide hands on experience with power electronic converter design and testing

LIST OF EXPERIMENTS:

1. Gate Pulse Generation using R,RC and UJT.
2. Characteristics of SCR and Triac
3. Characteristics of MOSFET and IGBT
4. AC to DC half controlled converter
5. AC to DC fully controlled Converter
6. Step down and step up MOSFET based choppers
7. IGBT based single phase PWM inverter
8. IGBT based three phase PWM inverter
9. AC Voltage controller
10. Switched mode power converter.
11. Simulation of PE circuits (1 Φ & 3 Φ semiconverter, 1 Φ & 3 Φ full converter, dc-dc converters, ac voltage controllers).

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Device characteristics (for SCR, MOSFET, TRIAC and IGBT kit with builtin / discrete power supply and meters) - 2 each
2. Single phase SCR based half controlled converter and fully controlled converter along with built-in/separate/firing circuit/module and meter – 2 each
3. MOSFET based step up and step down choppers (Built in/ Discrete) – 1 each
4. IGBT based single phase PWM inverter module/Discrete Component – 2
5. IGBT based three phase PWM inverter module/Discrete Component – 2
6. Switched mode power converter module/Discrete Component – 2
7. SCR & TRIAC based 1 phase AC controller along with lamp or rheostat load - 2
8. Cyclo converter kit with firing module –
9. Dual regulated Dc power supply with common ground
10. Cathode ray Oscilloscope – 10
11. Isolation Transformer – 5
12. Single phase Auto transformer – 3
13. Components (Inductance, Capacitance) 3 set for each
14. Multimeter – 5
15. LCR meter – 3
16. Rheostats of various ranges – 2 sets of 10 value
17. Work tables – 10
18. DC and AC meters of required ranges – 20
19. Component data sheets to be provided

613EEP02 - MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

OBJECTIVES:

To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.

LIST OF EXPERIMENTS:

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions:
 - (i) Ascending / Descending order, Maximum / Minimum of numbers
 - (ii) Programs using Rotate instructions
 - (iii) Hex / ASCII / BCD code conversions.
3. Interface Experiments: with 8085
 - (i) A/D Interfacing. & D/A Interfacing.
4. Traffic light controller.
5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source
7. Read a key ,interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including:
 - (i) Conditional jumps, looping
 - (ii) Calling subroutines.
- 9.. Programming I/O Port 8051
 - (i) study on interface with A/D & D/A
 - (ii) study on interface with DC & AC motor .
10. Mini project development with processors.

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.
- To understand and apply computing platform and software for engineering problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No. Description of Equipment Quantity required

1. 8085 Microprocessor Trainer with Power Supply 15
2. 8051 Micro Controller Trainer Kit with power supply15
3. 8255 Interface board 5
4. 8251 Interface board 5
5. 8259 Interface board 5
6. 8279 Keyboard / Display Interface board 5
7. 8254 timer counter 5
8. ADC and DAC card 5
9. AC & DC motor with Controller 5
10. Traffic Light Control System 5

613EEP03 - PRESENTATION SKILLS AND TECHNICAL SEMINAR

OBJECTIVES:

- To encourage the students to study advanced engineering developments
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

METHOD OF EVALUATION :

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. Each student is expected to present atleast twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

OUTCOMES:

- Ability to review, prepare and present technological developments
- Ability to face the placement interviews

VII Semester

713EET01 - HIGH VOLTAGE ENGINEERING

OBJECTIVES:

- To understand the various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination.

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary overvoltages, Corona and its effects – Reflection and Refraction of Travelling waves- Protection against overvoltages.

UNIT II DIELECTRIC BREAKDOWN

Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS

Generation of High DC, AC, impulse voltages and currents - Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS

High Resistance with series ammeter – Dividers, Resistance, Capacitance and Mixed dividers – Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION

High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second Edition Elsevier , New Delhi, 2005.
3. Subir Ray, ' An Introduction to High Voltage Engineering' PHI Learning Private Limited, New Delhi, Second Edition, 2013.

REFERENCES:

1. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.
2. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

713EET02 - PROTECTION AND SWITCHGEAR

OBJECTIVES:

- To educate the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- To introduce the characteristics and functions of relays and protection schemes.
- To impart knowledge on apparatus protection
- To introduce static and numerical relays
- To impart knowledge on functioning of circuit breakers

UNIT I PROTECTION SCHEMES

Principles and need for protective schemes – nature and causes of faults – types of faults – fault current calculation using symmetrical components – Methods of Neutral grounding – Zones of protection and essential qualities of protection – Protection schemes

UNIT II ELECTROMAGNETIC RELAYS

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Overcurrent, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION

Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, busbars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Overcurrent protection, transformer differential protection, distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Sunil S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 2008.
2. B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., First Edition 2011.
3. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co.,1998.

REFERENCES:

1. Badri Ram ,B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age International Pvt Ltd Publishers, Second Edition 2011.
2. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010
4. Ravindra P.Singh, ' Switchgear and Power System Protection', PHI Learning Private Ltd., New Delhi, 2009.
5. Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani, 'Protection and Switchgear' Oxford University Press, 2011.

713EET03 - SPECIAL ELECTRICAL MACHINES

OBJECTIVES:

- To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of stepping motors.
- To impart knowledge on the Construction, principle of operation, control and performance of switched reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- To impart knowledge on the Construction, principle of operation and performance of permanent magnet synchronous motors.

UNIT I SYNCHRONOUS RELUCTANCE MOTORS

Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance Motors – Voltage and Torque Equations - Phasor diagram - performance characteristics –Applications.

UNIT II STEPPER MOTORS

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Torque equations – Modes of excitation – Characteristics – Drive circuits – Microprocessor control of stepper motors – Closed loop control-Concept of lead angle– Applications.

UNIT III SWITCHED RELUCTANCE MOTORS (SRM)

Constructional features – Rotary and Linear SRM - Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers – Methods of Rotor position sensing – Sensor less operation – Characteristics and Closed loop control – Applications.

UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS

Permanent Magnet materials – Minor hysteresis loop and recoil line-Magnetic Characteristics – Permeance coefficient -Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations –Commutation - Power Converter Circuits and their controllers – Motor characteristics and control– Applications.

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM)

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature MMF – Synchronous Reactance – Sine wave motor with practical windings - Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements– Applications.

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
3. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

REFERENCES:

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
3. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
4. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

713EET04 - PRINCIPLES OF MANAGEMENT

OBJECTIVES:

□ To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

OUTCOMES:

□ Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. Stephen P. Robbins & Mary Coulter, " Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6th Edition, 2004.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, " Management", Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich "Essentials of Management" Tata McGraw Hill, 1998.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999.

Practical

713EEP01 - POWER SYSTEM SIMULATION LABORATORY

OBJECTIVES:

To provide better understanding of power system analysis through digital simulation

LIST OF EXPERIMENTS:

1. Computation of Parameters and Modelling of Transmission Lines
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
3. Load Flow Analysis - I : Solution of load flow and related problems using Gauss-Seidel Method
4. Load Flow Analysis - II: Solution of load flow and related problems using Newton Raphson.
5. Fault Analysis
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System
7. Transient Stability Analysis of Multi machine Power Systems
8. Electromagnetic Transients in Power Systems
9. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
10. Economic Dispatch in Power Systems.

OUTCOMES:

Ability to understand and analyze power system operation, stability, control and protection.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Personal computers (Pentium-IV, 80GB, 512 MBRAM) – 25 nos
2. Printer laser- 1 No.
3. Dot matrix- 1 No.
4. Server (Pentium IV, 80GB, 1GBRAM) (High Speed Processor) – 1 No.
5. Software: any power system simulation software - 5 licenses
6. Compilers: C, C++, VB, VC++ - 25 users

713EEP02 - COMPREHENSION

OBJECTIVES:

To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

METHOD OF EVALUATION:

The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics

OUTCOMES:

Ability to review, prepare and present technological developments

VIII Semester

813EET01 - ELECTRIC ENERGY GENERATION, UTILIZATION AND CONSERVATION

OBJECTIVES:

- To analyze the various concepts behind renewable energy resources.
- To introduce the energy saving concept by different ways of illumination.
- To understand the different methods of electric heating and electric welding.
- To introduce knowledge on Solar Radiation and Solar Energy Collectors
- To introduce concepts of Wind Energy and its utilization

UNIT I ELECTRIC DRIVES AND TRACTION

Fundamentals of electric drive - choice of an electric motor - application of motors for particular services - traction motors - characteristic features of traction motor - systems of railway electrification - electric braking - train movement and energy consumption - traction motor control - track equipment and collection gear.

UNIT II ILLUMINATION

Introduction - definition and meaning of terms used in illumination engineering - classification of light sources - incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps - design of illumination systems - indoor lighting schemes - factory lighting halls - outdoor lighting schemes - flood lighting - street lighting - energy saving lamps, LED.

UNIT III HEATING AND WELDING

Introduction - advantages of electric heating - modes of heat transfer - methods of electric heating - resistance heating - arc furnaces - induction heating - dielectric heating - electric welding - types - resistance welding - arc welding - power supply for arc welding - radiation welding.

UNIT IV SOLAR RADIATION AND SOLAR ENERGY COLLECTORS

Introduction - solar constant - solar radiation at the Earth's surface - solar radiation geometry - estimation of average solar radiation - physical principles of the conversion of solar radiation into heat - flat-plate collectors - transmissivity of cover system - energy balance equation and collector efficiency - concentrating collector - advantages and disadvantages of concentrating collectors - performance analysis of a cylindrical - parabolic concentrating collector - Feedin Invertors.

UNIT V WIND ENERGY

Introduction - basic principles of wind energy conversion - site selection considerations - basic components of a WECS (Wind Energy Conversion System) - Classification of WECS - types of wind Turbines - analysis of aerodynamic forces acting on the blade - performances of wind.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.

TEXT BOOKS:

1. N.V. Suryanarayana, "Utilisation of Electric Power", Wiley Eastern Limited, New Age International Limited, 1993.
2. J.B.Gupta, "Utilisation Electric power and Electric Traction", S.K.Kataria and Sons, 2000.
3. G.D.Rai, "Non-Conventional Energy Sources", Khanna Publications Ltd., New Delhi, 1997.

REFERENCES:

1. R.K.Rajput, Utilisation of Electric Power, Laxmi publications Private Limited., 2007.
2. H.Partab, Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co., New Delhi, 2004.
3. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International Pvt.Ltd., 2003.
4. S. Sivanagaraju, M. Balasubba Reddy, D. Srilatha, ' Generation and Utilization of Electrical Energy', Pearson Education, 2010.
5. Donalds L. Steeby, ' Alternative Energy Sources and Systems', Cengage Learning, 2012.

Project

813EEP01 - PROJECT WORK

OBJECTIVES:

To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination. The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

OUTCOMES:

On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

ELECTIVES

613EET06 - VISUAL LANGUAGES AND APPLICATIONS

OBJECTIVES :

- To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.
- To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.
- To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.
- To study about the integrated development programming event driven programming, variables, constants, procedures and basic ActiveX controls in visual basic.
- To understand the database and the database management system, visual data manager, data bound controls and ADO controls in VB.

UNIT I FUNDAMENTALS OF WINDOWS AND MFC

Messages - Windows programming - SDK style - Hungarian notation and windows data types - SDK programming in perspective. The benefits of C++ and MFC - MFC design philosophy - Document / View architecture - MFC class hierarchy - AFX functions. Application object - Frame window object - Message map. Drawing the lines - Curves - Ellipse - Polygons and other shapes. GDI pens - Brushes - GDI fonts - Deleting GDI objects and deselecting GDI objects. Getting input from the mouse: Client & Non-client - Area mouse messages - Mouse wheel - Cursor. Getting input from the keyboard: Input focus - Keystroke messages - Virtual key codes - Character & dead key messages.

UNIT II RESOURCES AND CONTROLS

Creating a menu - Loading and displaying a menu - Responding to menu commands - Command ranges - Updating the items in menu, update ranges - Keyboard accelerators. Creating menus programmatically - Modifying menus programmatically - The system menu - Owner draw menus - Cascading menus - Context menus. The C button class - C list box class - C static class - The font view application - C edit class - C combo box class - C scrollbar class. Modal dialog boxes - Modeless dialog boxes.

UNIT III DOCUMENT / VIEW ARCHITECTURE

The in existence function revisited - Document object - View object - Frame window object - Dynamic object creation. SDI document template - Command routing. Synchronizing multiple views of a document - Mid squares application - Supporting multiple document types - Alternatives to MDI. Splitter Windows: Dynamic splitter window - Static splitter windows. Creating & initializing a toolbar - Controlling the toolbar's visibility - Creating & initializing a status bar - Creating custom status bar panes - Status bar support in appwizard. Opening, closing and creating the files - Reading & Writing - C file derivatives - Serialization basics - Writing serializable classes.

UNIT IV FUNDAMENTALS OF VISUAL BASIC

Menu bar - Tool bar - Project explorer - Toolbox - Properties window - Form designer - Form layout - Intermediate window. Designing the user interface: Aligning the controls - Running the application - Visual development and event driven programming. Variables: Declaration - Types - Converting variable types - User defined data types - Lifetime of a variable. Constants - Arrays - Types of arrays. Procedures: Subroutines - Functions - Calling procedures. Text box controls - List box & Combo box controls - Scroll bar and slider controls - Filecontrols.

UNIT V DATABASE PROGRAMMING WITH VB

Record sets – Data control – Data control properties, methods. Visual data manager: Specifying indices with the visual data manager – Entering data with the visual data manager. Data bound listcontrol – Data bound combo box – Data bound grid control. Mapping databases: Database object – Table def object, Query def object. Programming the active database objects – ADO object model – Establishing a connection - Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating.

OUTCOMES:

- To understand and apply computing platform and software for engineering problems.

TEXT BOOKS:

1. Jeff Prosise, 'Programming Windows With MFC', Second Edition, WP Publishers & Distributors (P) Ltd, Reprinted, 2002.
2. Evangelos Petroustos, 'Mastering Visual Basic 6.0', BPB Publications, 2002.

REFERENCES:

1. Herbert Schildt, 'MFC Programming From the Ground Up', Second Edition, Tata McGraw Hill, reprinted, 2002.
2. John Paul Muller, 'Visual C++ 6 From the Ground Up Second Edition', Tata McGraw Hill, Reprinted, 2002.
3. Curtis Smith & Micheal Amundsen, 'Teach Yourself Database Programming with Visual Basic 6 in 21 days', Techmedia Pub, 1999.

OBJECTIVES :

- To provide knowledge on design in state variable form
- To provide knowledge in phase plane analysis.
- To give basic knowledge in describing function analysis.
- To study the design of optimal controller.
- To study the design of optimal estimator including Kalman Filter

UNIT I STATE VARIABLE DESIGN

Introduction to state Model- effect of state Feedback- Necessary and Sufficient Condition for Arbitrary Pole-placement- pole placement Design- design of state Observers- separation principle- servo design: -State Feedback with integral control.

UNIT II PHASE PLANE ANALYSIS

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearization Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

UNIT III DESCRIBING FUNCTION ANALYSIS

Basic concepts, derivation of describing functions for common non-linearities –
Describing function analysis of non-linear systems – limit cycles – Stability of oscillations.

UNIT IV OPTIMAL CONTROL

Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti's equation – Application examples.

UNIT V OPTIMAL ESTIMATION

Optimal estimation – Kalman Bucy Filter-Solution by duality principle-Discrete systems- Kalman Filter- Application examples.

OUTCOMES:

- Ability to apply advanced control theory to practical engineering problems.

TEXT BOOKS :

1. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2006.
2. G. J. Thaler, " Automatic Control Systems", Jaico Publishing House, 1993.
3. M.Gopal, Modern Control System Theory, New Age International Publishers, 2002.

REFERENCES:

1. William S Levine, "Control System Fundamentals," The Control Handbook, CRC Press, Tayler and Francies Group, 2011.
2. Ashish Tewari, 'Modern Control Design with Matlab and Simulink', John Wiley, New Delhi, 2002.
3. K. Ogata, 'Modern Control Engineering', 4th edition, PHI, New Delhi, 2002.
4. T. Glad and L. Ljung,, "Control Theory –Multivariable and Non-Linear Methods", Taylor & Francis, 2002.
5. D.S.Naidu, "Optimal Control Systems" First Indian Reprint, CRC Press, 2009.

613EET08 - POWER SYSTEM TRANSIENTS

OBJECTIVES:

- To study the generation of switching transients and their control using circuit – theoretical concept.
- To study the mechanism of lightning strokes and the production of lightning surges.
- To study the propagation, reflection and refraction of travelling waves.
- To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

UNIT I INTRODUCTION AND SURVEY

Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.

UNIT II SWITCHING TRANSIENTS

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restriking, with multiple restrikes. Illustration for multiple restriking transients - ferro resonance.

UNIT III LIGHTNING TRANSIENTS

Review of the theories in the formation of clouds and charge formation - rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke - factors contributing to good line design - protection using ground wires – tower footing resistance - Interaction between lightning and power system.

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS

Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram – standing waves and natural frequencies - reflection and refraction of travelling waves.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM

The short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - over voltage induced by faults – switching surges on integrated system Qualitative application of EMTP for transient computation.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2nd Edition, 1991.
2. Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2009.
3. C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients – A statistical approach', PHI Learning Private Limited, Second Edition, 2010.

REFERENCES:

1. M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2. R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.
3. Y.Hase, Handbook of Power System Engineering," Wiley India, 2012.
4. J.L.Kirtley, "Electric Power Principles, Sources, Conversion, Distribution and use," Wiley, 2012.

613EET09 - OPTIMISATION TECHNIQUES

OBJECTIVES:

- To introduce the basic concepts of linear programming
- To educate on the advancements in Linear programming techniques
- To introduce non-linear programming techniques
- To introduce the interior point methods of solving problems
- To introduce the dynamic programming method

UNIT I LINEAR PROGRAMMING

Introduction - formulation of linear programming model-Graphical solution-solving LPP using simplex algorithm – Revised Simplex Method.

UNIT II ADVANCES IN LPP

Dualit theory- Dual simplex method - Sensitivity analysis--Transportation problems- Assignment problems-Traveling sales man problem -Data Envelopment Analysis.

UNIT III NON LINEAR PROGRAMMING

Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.

UNIT IV INTERIOR POINT METHODS

Karmarkar’s algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.

UNIT V DYNAMIC PROGRAMMING

Formulation of Multi stage decision problem–Characteristics–Concept of sub-optimization and the principle of optimality–Formulation of Dynamic programming–Backward and Forward recursion–Computational procedure–Conversion of final value problem in to Initial value problem.

OUTCOMES:

- To understand ethical issues, environmental impact and acquire management skills.

TEXT BOOKS:

1. Hillier and Lieberman “Introduction to Operations Research”, TMH, 2000.
2. R.Panneerselvam, “Operations Research”, PHI, 2006
3. Hamdy ATaha, “Operations Research –An Introduction”, Prentice Hall India, 2003.

REFERENCES:

1. Philips, Ravindran and Solberg, “Operations Research”, John Wiley, 2002.
2. Ronald L.Rardin, “Optimization in Operation Research” Pearson Education Pvt. Ltd. New Delhi, 2005.

713EET05 - FIBRE OPTICS AND LASER INSTRUMENTS

OBJECTIVES:

- To expose the basic concepts of optical fibers and their industrial applications.
- To provide adequate knowledge about Industrial application of optical fibres.
- To provide basic concepts of lasers.
- To provide knowledge about Industrial application of lasers
- To provide knowledge about Industrial application of Holography and Medical applications of Lasers.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splicers – Fibre termination – Optical sources – Optical detectors.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES

Fibre optic sensors – Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III LASER FUNDAMENTALS

Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

UNIT IV INDUSTRIAL APPLICATION OF LASERS

Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

OUTCOMES:

- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:

1. R.P.Khare, Fiber Optics and Optoelectronics, Oxford university press, 2008.
2. J. Wilson and J.F.B. Hawkes, Introduction to Opto Electronics, Prentice Hall of India, 2001.

REFERENCES:

1. Asu Ram Jha, Fiber Optic Technology Applications to commercial, Industrial, Military and Space Optical systems, PHI learning Private limited, 2009.
2. M. Arumugam, Optical Fibre Communication and Sensors, Anuradha Agencies, 2002.
3. John F. Read, Industrial Applications of Lasers, Academic Press, 1978.

713EET06 - BIOMEDICAL INSTRUMENTATION

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals – Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO₂, pO₂, finger-tip oxymeter - ESR, GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS

Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current- Instruments for checking safety parameters of biomedical equipments.

UNIT IV IMAGING MODALITIES AND ANALYSIS

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopedic prostheses fixation.

OUTCOMES:

- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
2. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th Edition, 2012.
3. Khandpur R.S, Handbook of Biomedical Instrumentation, , Tata McGraw-Hill, New Delhi, 2nd Edition, 2003.

REFERENCES:

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

713EET07 - FLEXIBLE AC TRANSMISSION SYSTEMS

OBJECTIVES:

- To introduce the reactive power control techniques
- To educate on static VAR compensators and their applications
- To provide knowledge on Thyristor controlled series capacitors
- To educate on STATCOM devices
- To provide knowledge on FACTS controllers

UNIT I INTRODUCTION

Reactive power control in electrical power transmission lines -Uncompensated transmission line - series compensation – Basic concepts of Static Var Compensator (SVC) – Thyristor Controlled Series capacitor (TCSC) – Unified power flow controller (UPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS

Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator –Modelling of SVC for power flow and fast transient stability – Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS

Operation of the TCSC – Different modes of operation – Modelling of TCSC – Variable reactance model – Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit – Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS

Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability - prevention of voltage instability. SSSC-operation of SSSC and the control of power flow –modelling of SSSC in load flow and transient stability studies.

UNIT V CO-ORDINATION OF FACTS CONTROLLERS

Controller interactions – SVC – SVC interaction – Co-ordination of multiple controllers using linear control techniques – Control coordination using genetic algorithms.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. R.Mohan Mathur, Rajiv K.Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc, 2002.
2. Narain G. Hingorani, "Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, Delhi- 110 006, 2011.
3. K.R.Padiyar," FACTS Controllers in Power Transmission and Distribution", New Age International(P) Limited, Publishers, New Delhi, 2008.

REFERENCES:

1. A.T.John, "Flexible A.C. Transmission Systems", Institution of Electrical and Electronic Engineers (IEEE), 1999.
2. V.K.Sood,HVDC and FACTS controllers – Applications of Static Converters in Power System, APRIL 2004 , Kluwer Academic Publishers, 2004.
3. Xiao – Ping Zang, Christian Rehtanz and Bikash Pal, "Flexible AC Transmission System: Modelling and Control" Springer, 2012.

OBJECTIVES:

- To introduce the power quality problem
- To educate on production of voltages sags, over voltages and harmonics and methods of control.
- To study overvoltage problems
- To study the sources and effect of harmonics in power system
- To impart knowledge on various methods of power quality monitoring.

UNIT I INTRODUCTION TO POWER QUALITY

Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS

Sources of sags and interruptions - estimating voltage sag performance. Thevenin's equivalent source - analysis and calculation of various faulted condition. Voltage sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

UNIT III OVERVOLTAGES

Sources of over voltages - Capacitor switching - lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection - shielding - line arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.

UNIT IV HARMONICS

Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion - voltage and current distortion - harmonic indices - inter harmonics - resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters. IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer - quality measurement equipment - harmonic / spectrum analyzer - flicker meters - disturbance analyzer. Applications of expert systems for power quality monitoring.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Roger. C. Dugan, Mark. F. McGranaghan, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill, 2003. (For Chapters 1, 2, 3, 4 and 5).
2. Eswald.F.Fudis and M.A.S.Masoum, "Power Quality in Power System and Electrical Machines," Elsevier Academic Press, 2013.
3. J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', Wiley, 2011.

REFERENCES:

1. G.T. Heydt, 'Electric Power Quality', 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994). (For Chapter 1, 2, 3 and 5)
2. M.H.J Bollen, 'Understanding Power Quality Problems: Voltage Sags and Interruptions', (New York: IEEE Press, 1999). (For Chapters 1, 2, 3 and 5)
3. G.J.Wakileh, "Power Systems Harmonics - Fundamentals, Analysis and Filter Design," Springer 2007.
4. E.Aeha and M.Madrigal, "Power System Harmonics, Computer Modelling and Analysis," Wiley India, 2012.
5. R.S.Vedam, M.S.Sarma, "Power Quality - VAR Compensation in Power Systems," CRC Press 2013.
6. C. Sankaran, 'Power Quality', CRC press, Taylor & Francis group, 2002.

OBJECTIVES:

- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks
- To provide adequate knowledge about fuzzy and neuro-fuzzy systems
- To provide comprehensive knowledge of fuzzy logic control to real time systems.
- To provide adequate knowledge of genetic algorithms and its application to economic dispatch and unit commitment problems.

UNIT I ARCHITECTURES – ANN

Introduction – Biological neuron – Artificial neuron – Neuron model – Supervised and unsupervised learning- Single layer – Multi layer feed forward network – Learning algorithm- Back propagation network.

UNIT II NEURAL NETWORKS FOR CONTROL

Feedback networks – Discrete time Hopfield networks – Transient response of continuous time system – Applications of artificial neural network - Process identification – Neuro controller for inverted pendulum.

UNIT III FUZZY SYSTEMS

Classical sets – Fuzzy sets – Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules - Membership function – Knowledge base – Decision-making logic – Introduction to neuro fuzzy system- Adaptive fuzzy system.

UNIT IV APPLICATION OF FUZZY LOGIC SYSTEMS

Fuzzy logic control: Home heating system - liquid level control - aircraft landing- inverted pendulum – fuzzy PID control, Fuzzy based motor control.

UNIT V GENETIC ALGORITHMS

Introduction-Gradient Search – Non-gradient search – Genetic Algorithms: binary and real representation schemes, selection methods, crossover and mutation operators for binary and real coding - constraint handling methods – applications to economic dispatch and unit commitment problems.

OUTCOMES:

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.
- To understand and apply computing platform and software for engineering problems.

TEXT BOOKS:

1. Laurance Fausett, Englewood cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education, 1992.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill, 1997.
3. S.N.Sivanandam and S.N.Deepa, Principles of Soft computing, Wiley India Edition, 2nd Edition, 2013.

REFERENCES:

1. Simon Haykin, 'Neural Networks', Pearson Education, 2003.
2. John Yen & Reza Langari, 'Fuzzy Logic – Intelligence Control & Information', Pearson Education, New Delhi, 2003.
3. M.Gen and R,Cheng, Genetic algorithms and Optimization, Wiley Series in Engineering Design and Automation, 2000.
4. Hagan, Demuth, Beale, " Neural Network Design", Cengage Learning, 2012.
5. N.P.Padhy, " Artificial Intelligence and Intelligent Systems", Oxford, 2013.
6. William S.Levine, "Control System Advanced Methods," The Control Handbook CRC Press, 2011.

OBJECTIVES:

To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilmsmultilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO₂, MgO, ZrO₂, NiO, nanoalumina, CaO, AgTiO₂, Ferrites, Nanoclaysfunctionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

OUTCOMES:

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS :

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

713EET11 - SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL

OBJECTIVES:

- To introduce Non parametric methods
- To impart knowledge on parameter estimation methods
- To impart knowledge on Recursive identification methods
- To impart knowledge on Adaptive control schemes
- To introduce stability, Robustness and Applications of adaptive control method

UNIT I NON PARAMETRIC METHODS

Non parametric methods: Transient analysis–frequency analysis–Correlation analysis–Spectral analysis.

UNIT II PARAMETER ESTIMATION METHODS

Least square estimation – best linear unbiased estimation under linear constraints – updating the parameter estimates for linear regression models–prediction error methods: description of prediction methods – optimal prediction – relation between prediction error methods and other identification methods – theoretical analysis - Instrumental variable methods: Description of instrumental variable methods – Input signal design for identification.

UNIT III RECURSIVE IDENTIFICATION METHODS

The recursive least square method – the recursive instrumental variable methods- the recursive prediction error methods – Maximum likelihood. Identification of systems operating in closed loop: Identifiability considerations – direct identification – indirect identification.

UNIT IV ADAPTIVE CONTROL SCHEMES

Introduction – Types of adaptive control–Gain scheduling controller–Model reference adaptive control schemes–Self tuning controller–MRAC and STC: Approaches–The Gradient approach – Lyapunov functions – Passivity theory – pole placement method – Minimum variance control – Predictive control.

UNIT V ISSUES INADAPTIVE CONTROL AND APPLICATIONS

Stability – Convergence – Robustness –Applications of adaptive control.

OUTCOMES:

- Ability to apply advanced control theory to practical engineering problems.

TEXT BOOKS:

1. Soder Storm T and Peter Stoica, System Identification, Prentice Hall International,1989.
2. Astrom,K.J. and Wittenmark,B., "Adaptive Control",Pearson Education, 2nd Edition, 2001.
3. Sastry,S. and Bodson, M.," Adaptive Control– Stability, Convergence and Robustness", Prentice Hall inc., New Jersey, 1989.

REFERENCES:

1. Ljung L, System Identification: Theory for the user, Prentice Hall, Engle wood Cliffs,1987.
2. Bela.G.Liptak., "Process Control and Optimization"., Instrument Engineers' Handbook., volume 2, CRC press and ISA, 2005.
3. William S.Levine, "Control Systems Advanced Methods, the Control Handbook, CRC Press, 2011.

713EET12 - MICRO ELECTRO MECHANICAL SYSTEMS

OBJECTIVES:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I INTRODUCTION

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS-I

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

UNIT III SENSORS AND ACTUATORS-II

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV MICROMACHINING

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT V POLYMER AND OPTICAL MEMS

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

OUTCOMES:

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.

TEXT BOOKS:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

REFERENCES:

1. Nadim Maluf, " An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

713EET13 - MICROCONTROLLER BASED SYSTEM DESIGN

OBJECTIVES:

- To introduce the architecture of PIC microcontroller
- To educate on use of interrupts and timers
- To educate on the peripheral devices for data communication and transfer
- To introduce the functional blocks of ARM processor
- To educate on the architecture of ARM processors

UNIT I INTRODUCTION TO PIC MICROCONTROLLER

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–PIC16cxx-- Pipelining - Program Memory considerations - Register File Structure - Instruction Set - Addressing modes - Simple Operations.

UNIT II INTERRUPTS AND TIMER

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine - Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variable strings.

UNIT III PERIPHERALS AND INTERFACING

I2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM—Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR

ARM Architecture –ARM programmer’s model –ARM Development tools- Memory Hierarchy –ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems.

UNIT V ARM ORGANIZATION

3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

OUTCOMES:

- To understand and apply computing platform and software for engineering problems.
- To understand ethical issues, environmental impact and acquire management skills.

TEXT BOOKS:

1. Peatman,J.B., "Design with PIC Micro Controllers" Pearson Education, 3rd Edition, 2004.
2. Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCE:

1. Mazidi, M.A., "PIC Microcontroller" Rollin Mckinlay, Danny causey Printice Hall of India, 2007.

813EET02 - POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS

OBJECTIVES:

- To Provide knowledge about the stand alone and grid connected renewable energy systems.
- To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- To analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
- To design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems.
- To develop maximum power point tracking algorithms.

UNIT I INTRODUCTION

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION

Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III POWER CONVERTERS

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system- Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.

TEXT BOOK:

1. S. N. Bhadra, D.Kastha, S.Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi,2009.

REFERENCES:

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
3. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.
5. Andrzej M. Trzynadlowski, 'Introduction to Modern Power Electronics', Second edition, wiley India Pvt. Ltd, 2012.

813EET03 - HIGH VOLTAGE DIRECT CURRENT TRANSMISSION

OBJECTIVES:

- To understand the concept, planning of DC power transmission and comparison with AC Power transmission.
- To analyze HVDC converters.
- To study about the HVDC system control.
- To analyze harmonics and design of filters.
- To model and analysis the DC system under study state.

UNIT I INTRODUCTION

DC Power transmission technology – Comparison of AC and DC transmission – Application of DC transmission – Description of DC transmission system – Planning for HVDC transmission – Modern trends in HVDC technology – DC breakers – Operating problems – HVDC transmission based on VSC – Types and applications of MTDC systems.

UNIT II ANALYSIS OF HVDC CONVERTERS

Line commutated converter - Analysis of Graetz circuit with and without overlap - Pulse number – Choice of converter configuration – Converter bridge characteristics – Analysis of a 12 pulse converters – Analysis of VSC topologies and firing schemes.

UNIT III CONVERTER AND HVDC SYSTEM CONTROL

Principles of DC link control – Converter control characteristics – System control hierarchy – Firing angle control – Current and extinction angle control – Starting and stopping of DC link – Power control – Higher level controllers – Control of VSC based HVDC link.

UNIT IV REACTIVE POWER AND HARMONICS CONTROL

Reactive power requirements in steady state – Sources of reactive power – SVC and STATCOM – Generation of harmonics – Design of AC and DC filters – Active filters.

UNIT V POWER FLOW ANALYSIS IN AC/DC SYSTEMS

Per unit system for DC quantities – DC system model – Inclusion of constraints – Power flow analysis – case study.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Padiyar, K. R., "HVDC power transmission system", New Age International (P) Ltd., New Delhi, Second Edition, 2010.
2. Edward Wilson Kimbark, "Direct Current Transmission", Vol. I, Wiley interscience, New York, London, Sydney, 1971.
3. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age International (P) Ltd., New Delhi, 1990.

REFERENCES:

1. Kundur P., "Power System Stability and Control", McGraw-Hill, 1993.
2. Colin Adamson and Hingorani N G, "High Voltage Direct Current Power Transmission", Garraway Limited, London, 1960.
3. Arrillaga, J., "High Voltage Direct Current Transmission", Peter Pregrinus, London, 1983.
4. S. Kamakshaiah, V. Kamaraju, 'HVDC Transmission', Tata McGraw Hill Education Private Limited, 2011.

813EET04 - POWER SYSTEM DYNAMICS

OBJECTIVES:

- To introduce the basics of dynamics and stability problems
- To educate on modeling of synchronous machines
- To educate on the excitation system and speed-governing controllers.
- To study small signal stability of a single-machine infinite bus system with excitation system and power system stabilizer.
- To educate on the transient stability simulation of multi machine power system.

UNIT I INTRODUCTION

Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design – distinction between transient and dynamic stability - complexity of stability problem in large system – necessity for reduced models - stability of interconnected systems.

UNIT II SYNCHRONOUS MACHINE MODELLING

Synchronous machine - flux linkage equations - Park's transformation - per unit conversion - normalizing the equations - equivalent circuit - current space model - flux linkage state space model. Sub-transient and transient inductances - time constants. Simplified models (one axis and constant flux linkage) - steady state equations and phasor diagrams.

UNIT III MACHINE CONTROLLERS

Exciter and voltage regulators - function and types of excitation systems - typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit. Function of speed governing systems - block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

UNIT IV TRANSIENT STABILITY

State equation for multi machine system with one axis model and simulation – modelling of multi machine power system with one axis machine model including excitation system and speed governing system and simulation using R-K method of fourth order (Gill's technique) for transient stability analysis - power system stabilizer. For all simulations, the algorithm and flow chart have to be discussed.

UNIT V DYNAMIC STABILITY

System response to small disturbances - linear model of the unregulated synchronous machine and its modes of oscillation - regulated synchronous machine - distribution of power impact – linearization of the load equation for the one machine problem – simplified linear model - effect of excitation on dynamic stability - approximate system representation - supplementary stabilizing signals – dynamic performance measure - small signal performance measures.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. P.M. Anderson and A.A.Fouad, 'Power System Control and Stability', Galgotia Publications, New Delhi, 2003.
2. P. Kundur, 'Power System Stability and Control', McGraw Hill Inc., USA, 1994.
3. R.Ramanujam, "Power System Dynamics – Analysis and Simulation", PHI, 2009.

REFERENCES:

1. M.A.Pai and W.Sauer, 'Power System Dynamics and Stability', Pearson Education Asia, India, 2002.
2. James A.Momoh, Mohamed. E. EI-Hawary. " Electric Systems, Dynamics and Stability with Artificial Intelligence applications", Marcel Dekker, USA First Edition, 2000.
3. C.A.Gross, "Power System Analysis," Wiley India, 2011.
4. B.M.Weedy, B.J.Lory, N.Jenkins, J.B.Ekanayake and G.Strbac," Electric Power Systems", Wiley India, 2013.
5. K.Umarao, "Computer Techniques and Models in Power System," I.K. International, 2007.

813EET05 - PRINCIPLES OF ROBOTICS

OBJECTIVES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

UNIT I BASIC CONCEPTS

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and control issues- Various manipulators – Sensors - work cell - Programming languages.

UNIT II DIRECT AND INVERSE KINEMATICS

Mathematical representation of Robots - Position and orientation - Homogeneous transformation-Variou joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics-PUMA560 & SCARA robots- Solvability - Solution methods-Closed form solution.

UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV PATH PLANNING

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V DYNAMICS AND CONTROL

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model -Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

OUTCOMES:

- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:

1. R.K.Mittal and I.J.Nagrath, Robotics and Control,Tata McGraw Hill,New Delhi,4th Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss,R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

REFERENCES:

1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.
6. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.

813EET06 - PROFESSIONAL ETHICS IN ENGINEERING

OBJECTIVES:

□ To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

OUTCOMES:

□ Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6. World Community Service Centre, ' Value Education', Vethathiri publications, Erode, 2011.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

813EET07 - TOTAL QUALITY MANAGEMENT

OBJECTIVES:

To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.

OUTCOMES:

The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H. Besterfield, et al., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint, 2006.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

813EET08 - ADVANCED DIGITAL SIGNAL PROCESSING

OBJECTIVES:

- To bring out the concepts related to stationary and non-stationary random signals
- To emphasize the importance of true estimation of power spectral density
- To introduce the design of linear and adaptive systems for filtering and linear prediction
- To introduce the concept of wavelet transforms in the context of image processing

UNIT I DISCRETE-TIME RANDOM SIGNALS

Discrete random process – Ensemble averages, Stationary and ergodic processes, Autocorrelation and Autocovariance properties and matrices, White noise, Power Spectral Density, Spectral Factorization, Innovations Representation and Process, Filtering random processes, ARMA, AR and MA processes.

UNIT II SPECTRUM ESTIMATION

Bias and Consistency, Periodogram, Modified periodogram, Blackman-Tukey method, Welch method, Parametric methods of spectral estimation, Levinson-Durbin recursion.

UNIT III LINEAR ESTIMATION AND PREDICTION

Forward and Backward linear prediction, Filtering - FIR Wiener filter- Filtering and linear prediction, non-causal and causal IIR Wiener filters, Discrete Kalman filter.

UNIT IV ADAPTIVE FILTERS

Principles of adaptive filter – FIR adaptive filter – Newton's Steepest descent algorithm – LMS algorithm – Adaptive noise cancellation, Adaptive equalizer, Adaptive echo cancellers.

UNIT V WAVELET TRANSFORM

Multiresolution analysis, Continuous and discrete wavelet transform, Short Time Fourier Transform, Application of wavelet transform, Cepstrum and Homomorphic filtering.

OUTCOMES:

Upon completion of the course, students will be able to:

- Explain the parametric methods for power spectrum estimation.
- Discuss adaptive filtering techniques using LMS algorithm and the applications of adaptive filtering.
- Analyze the wavelet transforms.

TEXT BOOKS:

1. Monson H, Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, Indian Reprint, 2007.
2. John G.Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pearson, Fourth, 2007.
3. Dwight F. Mix, "Random Signal Processing", Prentice Hall, 1995.

REFERENCE:

1. Sophocles J. Orfanidis, "Optimum Signal Processing, An Introduction", McGraw Hill, 1990.

813EET09 - COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS

OBJECTIVES:

- To introduce the importance of computer aided design method.
- To provide basic electromagnetic field equations and the problem formulation for CAD applications.
- To get familiarized with Finite Element Method as applicable for Electrical Engineering.
- To introduce the organization of a typical CAD package.
- To introduce Finite Element Method for the design of different Electrical apparatus.

UNIT I INTRODUCTION

Conventional design procedures – Limitations – Need for field analysis based design – Review of Basic principles of energy conversion – Development of Torque/Force.

UNIT II MATHEMATICAL FORMULATION OF FIELD PROBLEMS

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential – Stored energy in Electric and Magnetic fields – Capacitance - Inductance- Laplace and Poisson's Equations – Energy functional.

UNIT III PHILOSOPHY OF FEM

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variational method- 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

UNIT IV CAD PACKAGES

Elements of a CAD System –Pre-processing – Modelling – Meshing – Material properties- Boundary Conditions – Setting up solution – Post processing.

UNIT V DESIGN APPLICATIONS

Voltage Stress in Insulators – Capacitance calculation - Design of Solenoid Actuator – Inductance and force calculation – Torque calculation in Switched Reluctance Motor.

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system.

TEXT BOOKS:

1. S.J Salon, 'Finite Element Analysis of Electrical Machines', Springer, YesDEE publishers, Indian reprint, 2007.
2. Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor & Francis, 2005.

REFERENCES:

1. Joao Pedro, A. Bastos and Nelson Sadowski, 'Electromagnetic Modeling by Finite Element Methods', Marcell Dekker Inc., 2003.
2. P.P.Silvester and Ferrari, 'Finite Elements for Electrical Engineers', Cambridge University Press, 1983.
3. D.A.Lowther and P.P Silvester, 'Computer Aided Design in Magnetics', Springer Verlag, New York, 1986.
4. S.R.H.Hoole, 'Computer Aided Analysis and Design of Electromagnetic Devices', Elsevier, New York, 1989.
5. User Manuals of MAGNET, MAXWELL & ANSYS Softwares.

813EET10 - VLSI DESIGN

OBJECTIVES:

- In this course, the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit is studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
- The main focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved as well as the topics covered are quite distinct from those encountered in courses on CMOS Analog IC design.

UNIT I MOS TRANSISTOR PRINCIPLE

NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT II COMBINATIONAL LOGIC CIRCUITS

Examples of Combinational Logic Design, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III SEQUENTIAL LOGIC CIRCUITS

Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS

Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff

UNIT V IMPLEMENTATION STRATEGIES

Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

OUTCOMES:

Upon completion of the course, students should

- Explain the basic CMOS circuits and the CMOS process technology.
- Discuss the techniques of chip design using programmable devices.
- Model the digital system using Hardware Description Language.

TEXTBOOKS:

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
2. M.J. Smith, "Application Specific Integrated Circuits", Addison Wesley, 1997

REFERENCES:

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addison Wesley 1993
2. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005
3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2007.

Registrar