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 – 2012)

(Effective from the Academic Year 2012-'13)

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING) PROGRAMME

Regulations and Syllabi

(Effective from 2012)

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		
Theory			**IA**	**EA**	**Total**
112EHT01	Technical English – I	1	25	75	100
112MAT02	Mathematics – I	3	25	75	100
112PHT03	Engineering Physics – I	3	25	75	100
112CYT04	Engineering Chemistry – I	3	25	75	100
112EGT05	Engineering Graphics – I	3	25	75	100
112FCT06	Fundamentals of Computing – I	3	25	75	100
Practical					
112CLP01	Computer Practices Laboratory – I	1	25	75	100
112ELP02	Engineering Practices Laboratory – I	1	25	75	100
	Total	**18**	**200**	**600**	**800**

II Semester

Code No.	Course Title	Credit	Marks		
Theory			**IA**	**EA**	**Total**
212EHT01	Technical English – II	2	25	75	100
212MAT02	Mathematics – II	3	25	75	100
212PHT03	Engineering Physics – II	2	25	75	100
212CYT04	Engineering Chemistry – II	2	25	75	100
212CTT05	Circuit Theory	3	25	75	100
212CMT06	Basic Civil & Mechanical Engineering	3	25	75	100
Practical					
212CLP01	Computer Practices Laboratory – II	1	25	75	100
212PCP02	Physics & Chemistry Laboratory – II	1	25	75	100
212ELP03	Electrical Circuits Laboratory	1	25	75	100
	Total	**18**	**225**	**675**	**900**

III Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
312MAT01	Transforms and Partial Differential Equations	3	25	75	100
312EET02	Measurements & Instrumentation	2	25	75	100
312EET03	Electromagnetic Theory	3	25	75	100
312EET04	Environmental Science and Engineering	2	25	75	100
312EET05	Electronic Devices & Circuits	2	25	75	100
312EET06	Data Structures and Algorithms	3	25	75	100
Practical					
312EEP01	Electron Devices & Circuits Laboratory	1	25	75	100
312EEP02	Data Structures and Algorithms Laboratory	1	25	75	100
312EEP03	Measurements & Instrumentation Laboratory	1	25	75	100
	Total	**18**	**225**	**675**	**900**

IV Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
412EET01	Numerical Methods	3	25	75	100
412EET02	Electrical Machines – I	3	25	75	100
412EET03	Power Plant Engineering	3	25	75	100
412EET04	Control Systems	2	25	75	100
412EET05	Linear Integrated Circuits and Applications	2	25	75	100
412EET06	Digital Logic Circuits	2	25	75	100
Practical					
412EEP01	Control Systems Laboratory	1	25	75	100
412EEP02	Linear and Digital Integrated Circuits Laboratory	1	25	75	100
412EEP03	Electrical Machines Laboratory – I	1	25	75	100
	Total	**18**	**225**	**675**	**900**

V Semester

Code No.		Credit	Marks		
Theory			**CA**	**EA**	**Total**
512EET01	Communication Engineering	2	25	75	100
512EET02	Digital Signal Processing	3	25	75	100
512EET03	Object Oriented Programming	2	25	75	100
512EET04	Power Electronics	2	25	75	100
512EET05	Electrical Machines II	3	25	75	100
512EET06	Transmission & Distribution	3	25	75	100
Practical					
512EEP01	Object Oriented Programming Laboratory	1	25	75	100
512EEP02	Power Electronics Laboratory	1	25	75	100
512EEP03	Electrical Machines II Laboratory	1	25	75	100
	Total	**18**	**225**	**675**	**900**

VI Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
612EET01	Power System Analysis	3	25	75	100
612EET02	Solid State Drives	3	25	75	100
612EET03	High Voltage Engineering	2	25	75	100
612EET04	Microprocessors & Microcontroller	2	25	75	100
612EET05	Design of Electrical Machines	3	25	75	100
612EET06	Computer Networks	2	25	75	100
612EET11	**Elective – I : Professional Ethics in Engineering**	2	25	75	100
Practical					
612EEP01	Microprocessor and Micro controller Laboratory	1	25	75	100
	Total	**18**	**200**	**600**	**800**

VII Semester

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
712EET01	Power System Operation and Control	3	25	75	100
712EET02	Protection & Switchgear	3	25	75	100
712EET03	Special Electrical Machines	3	25	75	100
712EET04	Principles of Management	2	25	75	100
712EET05	Operating Systems	3	25	75	100
712EET11	**Elective II : Non conventional Energy sources**	3	25	75	100
Practical					
712EEP01	Power System Simulation Laboratory	1	25	75	100
	Total	**18**	**175**	**525**	**700**

SEMESTER VIII

Code No.	Course Title	Credit	Marks		
Theory			**CA**	**EA**	**Total**
812EET01	Electric Energy Generation, Utilization and Conservation	3	25	75	100
812EET06	**Elective – III : HVDC Transmission**	3	25	75	100
812EET11	**Elective – IV : Flexible AC Transmission Systems**	3	25	75	100
Project					
812EEP01	Project	9	25	75	100
	Total	**18**	**100**	**300**	**400**

LIST OF ELECTIVES

Code No.	Course Title	Credit
Elective – I		
612EET07	Fibre Optics and Laser Instruments	2
612EET08	Visual Languages and Applications	2
612EET09	Advanced Control System	2
612EET10	Robotics & Automation	2
612EET11	**Professional Ethics in Engineering**	2
612EET12	Power System Transients	2
Elective – II		
712EET06	Bio-Medical Instrumentation	3
712EET07	Intelligent Control	3
712EET08	Power System Dynamics	3
712EET09	Computer Architecture	3
712EET10	Total Quality Management	3
712EET11	**Non Conventional Energy sources**	3
Elective – III		
812EET02	Power Quality	3
812EET03	System Identification and Adaptive Control	3
812EET04	Operations Research	3
812EET05	VLSI Design	3
812EET06	**HVDC Transmission**	3
Elective – IV		
812EET07	Fundamental of Nanoscience	3
812EET08	Micro Electro Mechanical Systems	3
812EET09	Software for Circuits Simulation	3
812EET10	CAD of Electrical apparatus	3
812EET11	**Flexible AC Transmission Systems**	3
812EET12	Wind Energy Conversation Systems	3
812EET13	Software for Circuit Simulation	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

112EHT01 - TECHNICAL ENGLISH – I

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

OBJECTIVES:

- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- 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 actiivities 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. a. 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. 2. Writing extended definitions
3. Speaking - role play activities, discussions, extempore speaking exercises speculating about the future.
   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, invititation 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
   a. problems and suggesting solutions.
4. Planning a tour, Writing a travel itinerary. Writing letters to officials and to the
   a. editor in formal/official contexts.
   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.

Extensive Reading:

1. 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.

112MAT02 - MATHEMATICS – I

UNIT I MATRICES

Characteristic equation – Eigen values and eigen vectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS

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

UNIT IV FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor's expansion – Maxima and Minima – Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral

TEXT BOOK:

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Third edition, Laxmi Publications(p) Ltd.,(2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, (2007).
3. Jain R.K and Iyengar S.R.K," Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

112PHT03 – ENGINEERING PHYSICS I

UNIT-I: ACOUSTICS & ULTRASONICS

Classifications of sound – Characteristics of musical sound – Intensity – Loudness – Weber Fechner law – Decibel – reverberation – reverberation time, derivation of Sabine's formula for reverberation – (Jager's Method) - absorption coefficient and its determination – factors affecting acoustics of building (optimum reverberation time, loudness, focusing, echo, echelon, effect, resonance, and noise) and their remedies – Ultrasonic production –Magnetostriction and piezoelectric methods – Properties – applications of ultrasonic with particular reference to detection of flaws in metal (Non – Destructive testing NDT) – SONAR.

UNIT II LASER & ITS APPLICATIONS

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einsteins A and B Coefficient – derivations. Types of lasers – He-Ne, CO2, Nd-YAG, Semiconductor lasers (homojunction & heterojunction) Qualitative Industrial Applications – Lasers in welding, heat treatment, cutting – Medical applications – Holography (construction & reconstruction).

UNIT III 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, BBC, FCC and HCP structure –Polymorphism and allotrophy – Crysal defects – point, line and surface defects.

UNIT IV PROPERTIES OF MATTER

Elasticity – types of moduli of elasticity – stress strain diagram –Young's modules of elasticity – rigidity modules – bulk modules – Factors affecting elasticity – twisting couple on a wire – Torsional pendulum – determination of rigidity modules of a wire – depression of a cantilever – Young's modulus by cantilever – uniform and non uniform bending – viscosity – Coefficient of viscosity – Determination of viscosity - Poiseuille's Method –Ostwalds viscometer – comparision of viscosities.

Unit V OPTICS & FIBER OPTICS

Air Wedge theory and experiment – testing of flat surfaces –anti reflection coating – Michelson interferometer – types of fringes, determination of wave length of monochromatic source and thickness of a thin transparent sheet – Double refraction – Photoelasticity – Photoelastic effect – Photoelastic analysis –Photoelastic material – Block diagram of a photoelastic bench.
Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle – Types – Types of optical fibres (material, refraction index, mode)- Double crucible technique of fibre drawing – Fibre drawing – Fibre optical communication system (Block diagram).

Text Book:

1. S.Stella Mary , m. Parasuraman and a. Mohammed Hidayathullah , 'Engineering Physics I R.K. Publishers, Coimbatore (2012)

REFERENCES:

1. R.K. Gaur and S.C.Gupta, "Engineering Physics" Dhanpat Rai Publications , New Delhi(2003)
2. M.N. Avadhanulu and PG Kshirsagar, 'A Text book of Engineering Physics' S.Chand and company, Ltd. New Delhi, 2005.
3. Serway and Jewett, 'Physics for Scientists and Engineering with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint (2007).
4. Rajendran, Vand Marikani A, 'Engineering Physics' Tata McGraw Hill Publications Ltd,lll edition New Delhi,(2004).
5. Palaniswamy, P.K. 'Engineering Physics' Scitech publications,Chennai,(2007)
6. Jayakumar.s 'Engineering Physics' , R.K.publishers, Coimbatore. (2007)
7. Jayakumar. S 'Engineering Physics', Pearson Education,New Delhi, (2007).
8. Dr. P. Santhana Raghavan, Dr.P. Ramasamy, Crystal Growth- Process and Methods –KRU Publications-Kumbakonam.

112CYT04 ENGINEERING CHEMISTRY –I

Aim

To impart a sound knowledge on principles of Chemistry involving industrial application oriented topics required for all engineering branches.

Objectives

* The student should be conversant with the principles, treatment of water for potable and industrial purposes
- Principles of polymer chemistry and its application in industries
- Industrial application of surface chemistry
- Conventional and Non- conventional energy sources and Principle and working of energy storage devices
- Chemistry of engineering materials and their industrial applications.

UNIT I WATER TECHNOLOGY

Characteristics –alkalinity-types of alkalinity and determination - Water - Hardness and problems -Estimation of Hardness by EDTA method - Problems in EDTA Titrations - Domestic water treatment-Disinfection methods (boiling, bleaching powder, chlorination UV treatment, ozonisation) Boiler feed water- Requirements -Disadvantages of using hard water in boilers-Scale and sludge formation, Carry over trouble, Caustic embrittlement and Boiler corrosion –Internal conditioning- colloidal,carbonate,phosphate and calgon conditioning methods. External conditioning -Zeolite Process and Demineralization process- Desalination - Reverse osmosis and Electro dialysis

UNIT II POLYMERS AND COMPOSITES

Polymers - Definition –Nomenclature -Functionality- Polymerization –Types -addition condensation, copolymerization and co-ordination polymerization –Mechanism of free radicaland Co-ordination polymerization -Plastics-Classification -Preparation .properties and uses of PVC, Teflon – Polycarbonates, Polyurethanes,Nylon 6,6, PET- Rubber-Vulcanisation of rubber ,synthetic rubber,Butyl rubber ,SBR.
Composites- Definition – Types of Composites - Polymer matrix composites –Metal matrix composites – Ceramic matrix composites ,properties and their application

UNIT III SURFACE CHEMISTRY

Adsorption – Terminology –Types- physical adsorption and chemical adsorption -Differences - Adsorption of gases on solids -Adsorption isotherms -Freundlich adsorption isotherm -Langmuir adsorption isotherm – Limitation. Adsorption of solutes from solutions - Ion exchange adsorption- Pollution abatement -Chromatography
Catalysis –Types-– Role of adsorbent in catalysis.

UNIT IV NON –CONVENTIONAL ENERGY SOURCES AND ENERGY STORAGE DEVICES

Nuclear energy – Difference between chemical and nuclear reactions -fusion and fission reactions – Binding energy – Mass defect-problems- Nuclear reactor- components -Light water nuclear power plant -Breeder reactor –Atom bomb.
Solar energy conversion-Solar cells, wind energy –-Fuel cells– Hydrogen-oxygen fuel cell – Batteries – Dry cell- alkaline battery -Lead - acid battery –Nickel –Cadmium battery - Lithium battery- Lithium – Sulphur battery.

UNIT V ENGINEERING MATERIALS

Refractories –classification –acidic, basic and neutral refractories-properties of refractories – refractoriness- refractoriness under load –dimensional stability-porosity-thermal spalling-chemical inertness-Manufacture of alumina, magnesite and zirconia bricks - Abrasives- natural and synthetic abrasives- Quartz, corundum, emery, garnet, diamond, silicon carbide ,alundum and boron carbide- Lubricants- Mechanism of lubrication – Classification - Solid lubricants-graphite and molybdenum disulphide.- Semi -Solid lubricants – Grease- Liquid lubricants -Synthetic lubricants - Blended oils -Properties- Viscosity ,Viscosity index, Flash and fire points, Cloud and pour points,Oiliness. and their significance –Adhesives -Classification and applications

Nano chemistry- Introduction –Properties –Carbon nanotubes –Classification – Synthesis – Applications

Text Books

1. P.C.Jain and Monica Jain , ''Engineering Chemistry'', Dhanpat Rai Pub Co Ltd New Delhi (2002)
2. S.S.Dara , '' A Text Book of Engineering Chemistry'', S.Chand & Co Ltd New Delhi (2006)
3. Dr.Sayeeda Sultana " Engineering chemistry '' Vol-I Professional and Technical Publishers, Coimbatore (2011)

Reference Books

1. B.K.Sharma ''Engineering Chemistry'',Krishna Prakasan Media (P) Ltd Meerut (2001)
2. B.Shiva Sankar ''Engineering Chemistry'',Tata McGraw-Hill Pub Co Ltd New Delhi (2008)

112EGT05 - ENGINEERING GRAPHICS

AIM
To develop graphic skills in students.

OBJECTIVES
To develop in students graphic skill for communication of concepts, ideas and design of engineering products and 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

Curves used in engineering practices:
Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves.

Free hand sketching:
Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES
Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT III PROJECTION OF SOLIDS
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

Perspective projection of prisms, pyramids and cylinders by visual ray method.

TEXT BOOKS:

1. N.D. Bhatt, "Engineering Drawing" Charotar Publishing House, 46th Edition, (2003).

REFERENCES:

1. K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2006).
2. M.S. Kumar, "Engineering Graphics", D.D. Publications, (2007).
3. K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited (2008).
4. M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education (2005).
5. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications (1998).
6. Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited (2008).
7. 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. Whenever the total number of candidates in a college exceeds 150, the University Examination in that college will be conducted in two sessions (FN and AN on the same day) for 50 percent of student (approx) at a time.

112FCT06 - FUNDAMENTALS OF COMPUTING AND PROGRAMMING

AIM :

To provide an awareness to Computing and Programming

OBJECTIVES :

- To enable the student to learn the major components of a computer system
- To know the correct and efficient ways of solving problems
- To learn to use office automation tools
- To learn to program in C

UNIT I INTRODUCTION TO COMPUTERS

Introduction – Characteristics of Computers – Evolution of Computers - Computer Generations – Classification of Computers – Basic Computer organization – Number Systems

UNIT II COMPUTER SOFTWARE

Computer Software –Types of Software – Software Development Steps – Internet Evolution - Basic Internet Terminology – Getting connected to Internet Applications.

UNIT III PROBLEM SOLVING AND OFFICE APPLICATION SOFTWARE

Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode -Application Software Packages- Introduction to Office Packages (not detailed commands for examination).

UNIT IV INTRODUCTION TO C

Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making - Branching and Looping.

UNIT V FUNCTIONS AND POINTERS

Handling of Character Strings – User-defined Functions – Definitions – Declarations - Call by reference – Call by value – Structures and Unions – Pointers – Arrays – The Preprocessor – Developing a C Program : Some Guidelines

TEXT BOOKS:

1. Ashok.N.Kamthane," Computer Programming", Pearson Education (India) (2008).
2. Behrouz A.Forouzan and Richard.F.Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks-Cole Thomson Learning Publications, (2007).

REFERENCES:

1. Pradip Dey, Manas Ghoush, "Programming in C", Oxford University Press. (2007).
2. Byron Gottfried, "Programming with C", 2nd Edition, (Indian Adapted Edition), TMH publications, (2006).
3. Stephen G.Kochan, "Programming in C", Third Edition, Pearson Education India, (2005).
4. Brian W.Kernighan and Dennis M.Ritchie, "The C Programming Language", Pearson Education Inc., (2005).
5. E.Balagurusamy, "Computing fundamentals and C Programming", Tata McGraw-Hill Publishing Company Limited, (2008).
6. S.Thamarai Selvi and R.Murugan, "C for All", Anuradha Publishers, (2008).

112CLP01 - COMPUTER PRACTICE LABORATORY – I

LIST OF EXERCISES

a) Word Processing

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart

b) Spread Sheet

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
8. Sorting and Import / Export features.

Simple C Programming

9. Data types, Expression Evaluation, Condition Statements.
10. Arrays
11. Structures and Unions
12. Functions

* For programming exercises Flow chart and pseudocode are essential

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

Hardware

☐LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.
☐Printers – 3 Nos.

Software

☐OS – Windows / UNIX Clone
☐Application Package – Office suite
☐Compiler – C

112ELP02 - 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 an 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. K.Jeyachandran, S.Natarajan & S, Balasubramanian, "A Primer on Engineering Practices Laboratory", Anuradha Publications, (2007).
2. T.Jeyapoovan, M.Saravanapandian & S.Pranitha, "Engineering Practices Lab Manual", Vikas Puplishing House Pvt.Ltd, (2006)
3. H.S. Bawa, "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P.M.M.S. Sarma, "Workshop Practice", Sree Sai Publication, (2002).
5. P.Kannaiah & K.L.Narayana, "Manual on Workshop Practice", Scitech Publications, (1999).

SEMESTER EXAMINATION PATTERN

The Laboratory examination is to be conducted for Group A & Group B, allotting 90 minutes for each group, with a break of 15 minutes. Both the examinations are to be taken together in sequence, either in the FN session or in the AN session. The maximum marks for Group A and Group B lab examinations will be 50 each, totaling 100 for the Lab course. The candidates shall answer either I or II under Group A and either III or IV under Group B, based on lots.

Engineering Practices Laboratory

List of equipment and components (For a Batch of 30 Students)

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets.
2. Carpentry vice (fitted to work bench)	15 Nos.
3. Standard woodworking tools	15 Sets.
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools:	
(a) Rotary Hammer	2 Nos
(b) Demolition Hammer	2 Nos
(c) Circular Saw	2 Nos
(d) Planer	2 Nos
(e) Hand Drilling Machine	2 Nos
(f) Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos.
2. Welding booth with exhaust facility	5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos.
5. Centre lathe	2 Nos.
6. Hearth furnace, anvil and smithy tools	2 Sets.
7. Moulding table, foundry tools	2 Sets.
8. Power Tool: Angle Grinder	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL

1. Assorted electrical components for house wiring	15 Sets
2. Electrical measuring instruments	10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4. Megger (250V/500V)	1 No.
5. Power Tools: (a) Range Finder	2 Nos
(b) Digital Live-wire detector	2 Nos

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
4. Multimeters 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

COMMON TO ALL BRANCHES

PHYSICS LABORATORY (Any Ten Experiments)

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Young's modulus of the material – uniform bending .
3. Determination of viscosity of liquid – Poiseuille's method.
4. Torsional pendulum – Determination of rigidity modulus.
5. Determination of the thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of the thickness of a thin wire – Air Wedge method.
7. (a) Particle size determination using Diode Laser.
   (b) Determination of Laser Parameters – Wave length, and angle of divergence.
   (c) Determination of acceptance angle in an optical fiber.
8. Spectrometer dispersive power of a prism.
9. Determination of Wave length of mercury spectrum –Spectrometer grating.
10. Determination of Band Gap of a Semiconductor diode.
11. Determination of velocity of sound and compressibility of liquid- Ultrasonic Interferometer.
12. Determination of Hysteresis loss in a ferromagnetic material

- **A minimum of FIVE experiments shall be offered in Each Semester.**
- **Laboratory classes on alternate weeks for physics and chemistry.**
- **The lab examinations will be held only in the second Semester.**

CHEMISTRY LABORATORY – I

LIST OF EXPERIMENTS

1. Estimation of hardness of Water by EDTA method

2. Estimation of Copper in brass by EDTA method

3. Determination of DO in water (Winkler's method)

4. Estimation of Chloride in Water sample (Argentometric)

5. Estimation of alkalinity of Water sample

6. Determination of molecular weight and degree of polymerization of a polymer by viscometry.

7. Determination of cloud and pour point of a Lubricating oil

- Any five experiments

212EHT01 - TECHNICAL ENGLISH II

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
Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:
1. Exercises on word formation using the prefix 'self' - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II
Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:
1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III
Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations .

Suggested activities:
1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object –verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
4. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:

1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:

1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TEXT BOOK:

1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

REFERENCES:

1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition, Pearson Education, 2007.

Extensive Reading:

1. Robin Sharma**, '**The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

Note:

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

212MAT02 - MATHEMATICS – II

UNIT I 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 II 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 parallelpipeds.

UNIT III ANALYTIC FUNCTIONS Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation.

UNIT IV COMPLEX INTEGRATION

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

UNIT V LAPLACE TRANSFORM Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TEXT BOOK:

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", 3rd Edition, Laxmi Publications (p) Ltd., (2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 3rd Edition, Pearson Education, (2007).
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 7th Edition, Wiley India, (2007).
4. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

212PHT03 – ENGINEERING PHYSICS II

UNIT I: CONDUCTING MATERIALS

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

UNIT II: SEMICONDUCTING MATERIALS

INSTRINSIC SEMICONDUCTOR: Intrinsic semiconductor – Density of electrons in conduction band – Density of holes in valence band – Intrinsic carrier concentration – derivation – Fermi level – Variation – of Fermi with temperature – electrical conductivity – mobility – band gap determination. EXTRINSIC SEMICONDUCTOR: Extrinsic semiconductors – carrier concentration derivation in n- type and p- type semiconductor variation of Fermi level with temperature and impurity concentration – compound semiconductors.

UNIT III: DIELECTRIC MATERIALS

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

UNIT IV: QUANTUM AND SUPER CONDUCTING MATERIALS

Black body radiation – Planck's theory (derivation) – Deduction of Wien' displacement law and Rayleigh – jeans' Law from Planck's theory - Compton Effect – Theory and experimental verification – Matter waves – Schrodinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box – Superconductivity: Properties – Types of super conductors – BCS theory of superconductivity(Qualitative) – High Tc superconductors – Applications of super conductors - SQUID, cryotron, magnetic levitation.

UNIT V: NEW ENGINEERING & NANO MATERIALS

Metallic glasses: Preparation, properties and applications – Shape memory alloys (SMA): Characteristic, Properties of NiTi alloy, application, advantages and disadvantages of SMA-synthesis –Plasma arcing – Chemical vapour deposition – sol-gels – eletrodeposition – ball milling – properties of nanoparticles and applications Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition –Structure – properties and applications.

Text Books:

1. S. Stella Mary, M. Parasuraman and A. Mohammed Hidayathullah, 'Engineering Physics ll' R.K Publishers, Coimbatore(2012).

REFERENCES:

1. Charles Kittel 'Introduction to solid state physics', John Wiley & Sons, 7th edition, Singapore (2007).
2. Charles P.Poole and Frank J. Ownen, 'Introduction to nanotechnology' Wiley India (2007)(for unit V)
3. Rajendran. v and Marikani.A. 'Materials Science' Tata McGraw hill publications, (2004) New Delhi.
4. Jayakumar. S, 'Materials Science' R.K. Publishers, Coimbatore, (2008).
5. Palanisamy P.K, 'Materials Science' , Scitech publications (India) Pvt. Ltd., Chennai, Second Edition(2007).
6. M. Arumugam, 'Materials Science' Anuradha Publications, Kumbakonam, (2006).

212CYT04 ENGINEERING CHEMISTRY –II

To impart a sound knowledge on principles of Chemistry involving industrial application oriented topics required for all engineering branches.

Objectives

* The student should be conversant with the principles of Electrochemistry Electrochemical cells and their applications.
- Principles of corrosion and its inhibition.
* Chemistry of fuels and combustion.
- Importance of phase rule , alloys and their industrial application.
- Analytical techniques and their instrumentation.

UNIT I ELECTROCHEMISTRY

Electrochemical cells-Reversible and irreversible cells-Concentration cells -EMF Measurement of emf- Single electrode potential -Nernst equation(problem)-Reference electrodes-Standard hydrogen electrode-Calomel electrode-Ion selective electrode-Glass electrode-Measurement of pH-Electrochemical series-significance- Potentiometric titration (redox Fe^{2+}Vs Dichromate,) -Conductometric titrations (acid-base and precipitation titrations)

UNIT II CORROSION AND CORROSION CONTROL

Chemical corrosion –Pilling- Bedworth rule-electrochemical corrosion –mechanism Different types of corrosion-Galvanic corrosion-Differential aeration corrosion –pitting corrosion-waterline corrosion –stress corrosion –crevice corrosion-Factors influencing corrosion -corrosion control-sacrificial anode and impressed cathodic current methods-corrosion inhibitors –protective coatings-paints-constituents-functions- metallic coatings- anodic coating –cathodic coating- metal cladding -diffusion coating - electroplating of gold and electroless plating of nickel.

UNIT III FUELS AND COMBUSTION

Calorific value –Classification-coal -Proximate analysis and Ultimate analysis-Metallurgical Coke-Manufacture by Bee-hive oven and Otto-Hoffmann method-Petroleum processing and fractions-Cracking -Catalytic cracking and methods-Knocking –octane number –cetane number-Synthetic petrol-Fischer –Tropsch and Bergius process-Gaseous fuels-,Water gas-Producer gas., CNG and LPG-Flue gas analysis-Orsat apparatus-Theoretical air for combustion-Problems

UNIT IV PHASE RULE AND ALLOYS

Statement and Explanation of terms involved with examples- Phase diagram-One Component system-Water system- Condensed phase rule-Construction of phase diagram by Thermal analysis-Simple eutectic system(Lead-silver system only)- Limitations of phase rule-Alloys-importance of Ferrous alloys-Nichrome-Alnico -Stainless steel-Heat treatment of steel -Non-Ferrous alloys -Brass and Bronze

UNIT V ANALYTICAL TECHNIQUES

Spectroscopy –Atomic and molecular spectroscopy-Absorption spectrum –Emission spectrum **–** Absorbance**-**Beer-Lamberts law-Problems-UV Visible spectroscopy -IR spectroscopy-(principle,instrumentation (block diagram only)and applications colorimetry(principle ,instrumentation and applications)-Estimation of iron by colorimetry.Flame photometry-(principle , instrumentation and applications)-Estimation of Sodium by Flame photometry-Atomic absorption spectroscopy(principle , instrumentation and applications)-Estimation of Nickel by Atomic absorption spectroscopy.

Text Books

1. P.C.Jain and Monica Jain , ''Engineering Chemistry'', Dhanpat Rai Pub Co Ltd ,New Delhi (2002)
2. S.S.Dara , '' A Text Book of Engineering Chemistry'', S.Chand & Co Ltd New Delhi (2006)
3. Dr.Sayeeda Sultana " Engineering chemistry '' Vol –II, Professional and Technical publishers ,Coimbatore (2011)

Reference Books

1. B.K.Sharma ''Engineering Chemistry'',Krishna Prakasan Media (P) Ltd Meerut (2001)
2. B.Shiva Sankar ''Engineering Chemistry'',Tata McGraw-Hill Pub Co Ltd New Delhi **(** 2008)

212CCT05 - CIRCUIT THEORY

(Common to EEE and EIE)

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.

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 Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III RESONANCE AND COUPLED CIRCUITS

Series and paralled 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.

UNIT V ANALYSING 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 & un balanced – 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, (2002).
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).

REFERENCES:

1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi (2001).
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003)

212CMT06 - BASIC CIVIL & MECHANICAL ENGINEERING

(Common to EEE & EIE)

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 I C 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 Prahu Raja V, "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2000).

212CLP01 - COMPUTER PRACTICE LABORATORY – II

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

COMMON TO ALL BRANCHES

PHYSICS LABORATORY (Any Ten Experiments)

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Young's modulus of the material – uniform bending .
3. Determination of viscosity of liquid – Poiseuille's method.
4. Torsional pendulum – Determination of rigidity modulus.
5. Determination of the thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of the thickness of a thin wire – Air Wedge method.
7. (a) Particle size determination using Diode Laser.
(b) Determination of Laser Parameters – Wave length, and angle of divergence.
(c) Determination of acceptance angle in an optical fiber.
8. Spectrometer dispersive power of a prism.
9. Determination of Wave length of mercury spectrum –Spectrometer grating.
10. Determination of Band Gap of a Semiconductor diode.
11. Determination of velocity of sound and compressibility of liquid- Ultrasonic Interferometer.
12. Determination of Hysteresis loss in a ferromagnetic material

- **A minimum of FIVE experiments shall be offered in Each Semester.**
- **Laboratory classes on alternate weeks for physics and chemistry.**
- **The lab examinations will be held only in the second Semester.**

CHEMISTRY LABORATORY – II

LIST OF EXPERIMENTS

1. Conductometric titration (Simple acid base)

2. Conductometric titration (Mixture of weak and strong acidsVs base)

3. Conductometric titration using $BaCl_2$ Vs Na_2 SO_4

4. Potentiometric Titration (Fe^{2+}/KMnO4 or $K_2Cr_2O_7$)

5. PH titration (acid & base)

6. Determination of water of crystallization of a crystalline salt (Copper sulphate)

7. Estimation of Ferric iron by spectrophotometry.

8. Estimation of sodium and potassium by flame photometry.

- Any five experiments.

212ELP03 - ELECTRICAL CIRCUIT LABORATORY
(Common to EEE, EIE and ICE)

LIST OF EXPERIMENTS

1. Verification of ohm's laws and kirchoff's laws.
2. Verification of Thevemin's and Norton's Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
9. Frequency response of series and parallel resonance circuits.
10. Frequency response of single tuned coupled circuits.

SEMESTER III

312MAT01 - TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS
(Common to all branches)

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differtial Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

1. 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 identify – Harmonic Analysis.

2. FOURIER TRANSFORM

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

3. PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations - Lagrange's linear equation - Solution of standard types of first order partial differential equations – Linear partial differential equations of second and higher order with constant coefficients.

4. APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat equation (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

5. Z -TRANSFORM AND DIFFERENCE EQUATIONS

Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z - transform.

TEXTBOOKS

1. Grewal B.S, 'Higher Engineering Mathematics', 39th Edition, Khanna Publishers, Delhi, 2007

REFERENCE BOOKS

1. Bali.N.P. and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications (P) Ltd.
2. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company Limited, New Delhi.
3. Glyn James ' ADVANCED MODERN ENGINEERING MATHEMATICS', Third edition – Pearson education – 2007.
4. ERWIN KREYSZIG ' ADVANCED ENGINEERING MATHEMATICS' Eighth Edition – WILEY INDIA – 2007.

312EET02 - MEASUREMENTS AND INSTRUMENTATION

AIM

To provide adequate knowledge in electrical instruments and measurements techniques.

OBJECTIVES

To make the student have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working.

- Introduction to general instrument system, error, calibration etc.
- Emphasis is laid on analog and digital techniques used to measure voltage, current, energy and power etc.
- To have an adequate knowledge of comparison methods of measurement.
- Elaborate discussion about storage & display devices.
- Exposure to various transducers and data acquisition system.

1. INTRODUCTION

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

2. 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.

3. 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.

4. STORAGE AND DISPLAY DEVICES

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

5. TRANSDUCERS AND DATA ACQUISITION SYSTEMS

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

TEXT BOOKS

1. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.

REFERENCE BOOKS

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

312EET03 - ELECTROMAGNETIC THEORY

AIM

This subject aims to provide the student an understanding of the fundamentals of electromagnetic fields and their applications in Electrical Engineering.

OBJECTIVES

- To impart knowledge on
- Concepts of electrostatics, electrical potential, energy density and their applications.
- Concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- Faraday's laws, induced emf and their applications.
- Concepts of electromagnetic waves and Poynting vector.

1. INTRODUCTION

Sources and effects of electromagnetic fields – Vector fields – Different co-ordinate systems-vector calculus – Gradient, Divergence and Curl - Divergence theorem – Stoke's theorem.

2. ELECTROSTATICS

Coulomb's Law – Electric field intensity – Field due to point and continuous charges – Gauss's law and application – Electric potential – Electric field and equipotential plots – Electric field in free space, conductors, dielectric -Dielectric polarization - Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations – Capacitance- Energy density.

3. MAGNETOSTATICS

Lorentz Law of force, magnetic field intensity – Biot–savart Law - Ampere's Law – Magnetic field 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 – Magnetic force – Torque – Inductance – Energy density – Magnetic circuits.

4. ELECTRODYNAMIC FIELDS

Faraday's laws, induced emf – Transformer and motional EMF – Forces and Energy in quasi-stationary Electromagnetic Fields - Maxwell's equations (differential and integral forms) – Displacement current – Relation between field theory and circuit theory.

5. ELECTROMAGNETIC WAVES

Generation – Electro Magnetic Wave 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 – Transmission lines – Line equations – Input impedances – Standing wave ratio and power.

TEXT BOOKS

1. Mathew N. O. SADIKU, 'Elements of Electromagnetics', Oxford University press Inc. First India edition, 2007.
2. Ashutosh Pramanik, 'Electromagnetism – Theory and Applications', Prentice-Hall of India Private Limited, New Delhi, 2006.

REFERENCE BOOKS

1. Joseph. A.Edminister, 'Theory and Problems of Electromagnetics', Second edition, Schaum Series, Tata McGraw Hill, 1993.
2. William .H.Hayt, 'Engineering Electromagnetics', Tata McGraw Hill edition, 2001.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 1999.

312EET04 - ENVIRONMENTAL SCIENCE AND ENGINEERING (Credit=2)
(Common to EEE, EIE, Biotech, Chemical)

AIM

The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make him/her sensitive to the environment problems in every professional endeavour that he/she participates.

OBJECTIVES

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity.

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

Definition, Scope and Importance – Need For Public Awareness – Forest Resources:- Use and Over - Exploitation, Deforestation, Case Studies, Timber Extraction, Mining, Dams and their Ground Water, Floods, Drought, Conflicts Over Water, Dams - Benefits and Problems – Mineral Resources:- Use Effects on Forests and Tribal People – Water Resources:- Use and Over-Utilization of Surface 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, 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. Field Study of Local Area to Document Environmental assets – River/Forest/Grassland/Hill/ Mountain.

ECOSYSTEMS AND BIODIVERSITY

Concepts of an Ecosystem – Structure and Function of an Ecosystem – Producers, Consumers and Decomposers – Energy Flow in the Ecosystem – Ecological Succession – Food Chains, Food Webs and Ecological Pyramids – 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 and Birds - Field Study of Simple Ecosystems – Pond, River, Hill Slopes, etc.

ENVIRONMENTAL POLLUTION

Definition – Causes, Effects and Control Measures of:- (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Soil Waste Management:- Causes, Effects and Control Measures of Urban and Industrial Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – disaster Management:- Floods, Earthquake, Cyclone and Landslides.

Field Study of Local Polluted Site – Urban/Rural/Industrial/Agricultural

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 – Environmental Ethics:- Issues and Possible Solutions – Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents

and Holocaust, Case Studies – Wasteland Reclamation – Consumerism and Waste Products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues Involved in enforcement of Environmental Legislation – Public Awareness.

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 – Role of Information Technology in Environment and Human Health – Case Studies.

TEXT BOOKS

1. Masters, G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., 2nd Edition, 2004.
2. Miller, T.G. Jr., "Environmental Science", Wadsworth Pub. Co.
3. Townsend C., Harper, J. and Begon, M., "Essentials of Ecology", Blackwell Science, 2003.
4. Trivedi, R.K., and Goel, P.K., "Introduction to Air Pollution", Techno- Science Publications.

REFERENCE BOOKS

1. Erach, B., "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmedabad, India.
2. Trivedi, R.K., "Handbook of Environmental Law's, Rules, Guidelines,Compliances and Standards", Vol - I and II, Envio Media.
3. Cunningham., Cooper, W.P. and Gorhani, T.H., "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.
4. Wages, K.D., "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.

312EET05 - ELECTRONIC DEVICES AND CIRCUITS

AIM

To study the characteristics and applications of electronic devices.

OBJECTIVES

To acquaint the students with construction, theory and characteristics of the following electronic devices:

- p-n junction diode
- Bipolar transistor
- Field effect transistor
- LED, LCD and other photo electronic devices
- Power control / regulator devices

1. PN DIODE AND ITS APPLICATIONS

PH junction diode-VI characteristics – Rd, temperature effects – Drift ad diffusion currents – switching – Rectifiers: HWR, FWR, BR, filters-Zener diode – VI characteristics, Regulators (series and shunt), LED, LCD characteristics and applications.

2. BJT AND ITS APPLICATIONS

Junction transistor – Transistor construction – Input and output characteristics – CE, CB and CC configurations – hybrid model – Analytical expressions – switching – RF application – Power transistors – Opto couplers.

3. FET AND ITS APPLICATIONS

FET – VI characteristics, VP, JFET – small signal model – LF and HF equivalent circuits – CS and CD amplifiers –cascade and cascade – Darlington connection – MOSFET - Characteristics – enhancement and depletion

4. AMPLIFIERS AND OSCILLATORS

Differential amplifiers: CM and DM – condition for ofc-feedback amplifiers – stability – Voltage / current, series / shunt feedback – oscillators – LC, RC, crystal

5. PULSE CIRCUITS

RC wave shaping circuits – Diode clampers and clippers – Multivibrators – Schmitt triggers – UJT based saw tooth oscillators.

TEXT BOOK

1.Paynter, "Introductory lectronic devices and circuits, 2006, PHI
2.David Bell "Electronic Devices and Circuits" 2007, PHI

REFERENCES

1. Theodre F.Boghert, "Electronic Devices & Circuits" Pearson Education, VI Edition, 2003
2. Rashid, "Microelectronic circuits" Thomson Publication, 1999
3. B.P.Singh & Rekha Sing, "Electronic Devices and Integrated Circuits" Pearson Education, 2006.

312EET06 - DATA STRUCTURES AND ALGORITHMS
(Common to EEE, EIE & ICE)

Aim: To master the design and applications of linear, tree, and graph structures. To understand various algorithm design and analysis techniques.

UNIT I LINEAR STRUCTURES

Abstract Data Types (ADT) – List ADT – array-based implementation – linked list implementation – cursor-based linked lists – doubly-linked lists – applications of lists – Stack ADT – Queue ADT – circular queue implementation – Applications of stacks and queues

UNIT II TREE STRUCTURES

Need for non-linear structures – Tree ADT – tree traversals – left child right sibling data structures for general trees – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT

UNIT III BALANCED SEARCH TREES AND INDEXING

AVL trees – Binary Heaps – B-Tree – Hashing – Separate chaining – open addressing – Linear probing

UNIT IV GRAPHS

Definitions – Topological sort – breadth-first traversal - shortest-path algorithms – minimum spanning tree – Prim's and Kruskal's algorithms – Depth-first traversal – biconnectivity – euler circuits – applications of graphs

UNIT V ALGORITHM DESIGN AND ANALYSIS

Greedy algorithms – Divide and conquer – Dynamic programming – backtracking – branch and bound – Randomized algorithms – algorithm analysis – asymptotic notations – recurrences – NP-complete problems

TEXT BOOKS

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education Asia, 2002.
2. ISRD Group, "Data Structures using C", Tata McGraw-Hill Publishing Company Ltd., 2006.

REFERENCES

1. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
2. R. F. Gilberg, B. A. Forouzan, "Data Structures: A Pseudocode approach with C", Second Edition, Thomson India Edition, 2005.
3. Sara Baase and A. Van Gelder, "Computer Algorithms", Third Edition, Pearson Education, 2000.
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", Second Edition, Prentice Hall of India Ltd, 2001.

312EEP01 - ELECTRON DEVICES AND CIRCUITS LABORATORY
(B.E. (EEE), B.E. (E&I) and B.E. (I & C)
(Revised)

1. Characteristics of Semiconductor diode and Zener diode.
2. Characteristics of Transistor under common emitter, common collector and common base configurations.
3. Characteristic of FET
4. Characteristic of UJT.
5. Characteristics of SCR, DIAC and TRIAC.
6. Photo diode, phototransistor Characteristics and study of light activated relay circuit..
7. Static characteristics of Thermistors.
8. Single phase half wave and full wave rectifiers with inductive and capacitive filters.
9. Differential ampliers using FET.
10. Study of CRO
11. Series and Parallel reasonance circuits.
12. Realization of Passive filters.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Regulated Power Supply	15		
2.	Dual Tree CRO (20 MHz)	15		
3.	Function Generator	15		
4.	$3^{1/2}$ Digit digital multimeter	10		
5.	Bread Boards	40		
6.	Transistor	25 Nos.		
7.	JFET	10 Nos.		
8.	Diode	10 Nos.		
9.	Zener Diode	5 Nos.		
10.	UJT	5 Nos.		
11.	Photo Diode	5 Nos.		
12.	Photo Transistor	5 Nos.		
13.	Thermistors	5 Nos.		
14.	OP-amp	10 Nos.		
15.	Milli Ammeter (0-100mA)	15 Nos.		
16.	Micro Ammeter (0-50μA)	10 Nos.		
17.	Low range voltmeter (0-30V)	10 Nos.		
18.	Resistor of various ranges	50 Nos.		
19.	Capacitors of various ranges	50 Nos.		
20.	Connecting wires	Sufficient Nos		

312EEP02 - DATA STRUCTURES AND ALGORITHMS LABORATORY
(Common to EEE, EIE& ICE)

Aim:
To develop skills in design and implementation of data structures and their applications.

1. Implement singly and doubly linked lists.
2. Represent a polynomial as a linked list and write functions for polynomial addition.
3. Implement stack and use it to convert infix to postfix expression
4. Implement array-based circular queue and use it to simulate a producer-consumer problem.
5. Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
6. Implement binary search tree.
7. Implement insertion in AVL trees.
8. Implement priority queue using heaps
9. Implement hashing techniques
10. Perform topological sort on a directed graph to decide if it is acyclic.
11. Implement Dijkstra's algorithm using priority queues
12. Implement Prim's and Kruskal's algorithms
13. Implement a backtracking algorithm for Knapsack problem
14. Implement a branch and bound algorithm for traveling salesperson problem
15. Implement any randomized algorithm.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Hardware Required			
2.	Computer(Pentium 4)	40 Nos with one server		
3.	Dot matrix printer	3 Nos		
4.	Laser Printer	2 Nos		
5.	UPS (5 KVA)	2		
6.	Software Required			
7.	Turbo C	40 Nodes		

312EEP03 - MEASUREMENTS AND INSTRUMENTATION LABORATORY

AIM

The aim of this lab is to fortify the students with an adequate work experience in the measurement of different quantities and also the expertise in handling the instruments involved.

OBJECTIVE

To train the students in the measurement of displacement, resistance, inductance, torque and angle etc., and to give exposure to AC, DC bridges and transient measurement.

1. Study of displacement and pressure transducers
2. AC bridges.
3. DC bridges.
4. Instrumentation amplifiers.
5. A/D and D/A converters.
6. Study of transients.
7. Calibration of single-phase energy meter.
8. Calibration of current transformer.
9. Measurement of three phase power and power factor.
10. Measurement of iron loss.

Detailed Syllabus

1(a) Study of Displacement Transducer - LVDT

Aim

To study the operation of LVDT

Objectives

- To study the basic principle of LVDT.
- Study of signal conditioning circuit.
- Study of LVDT as transducer.

Exercise

1. Draw the characteristic curve for a given LVDT.
2. Find the residual voltage.
3. Fluid the non-electrical quantity displacement interms of voltage.
4. Equipment
   i. LVDT kit – 1 No
   ii. Multimeter – 1 No

1(b) Study of Pressure Transducer

Aim

To study the operation of bourdon tube

Objectives

- To study the basic principle of Bourdon tube.
- Study of Bourdon tube as transducer.

Exercise

1. Draw the characteristic curve for a given Bourdon tube i.e. pressure vs. o/p (V or I).
2. Measure the non-electrical quantity pressure interms of voltage or current.

Equipment

i. Bourdon pressure transducer kit – 1 No
ii. Foot pump – 1 No
iii. Voltmeter – 1 No
iv. Multimeter – 1 No

2. AC BRIDGES

a) Maxwell's Inductance – Capacitance Bridge

Aim

To find the unknown inductance and Q factor of a given coil.

Objective

- To find the unknown inductance of the given coil using bridge circuit.
- To study that Maxwell inductance, capacitance bridge is suitable for the measurement of law Q coils.

Exercise

1. Design a bridge circuit for the given parameters.
2. Fluid Q factor of the coil.
3. Fluid unknown Inductance.

Equipment

i. Maxwell's inductance Capacitance Bridge kit – 1 No
ii. Multimeter – 1 No
iii. Unknown Inductance – 1 No

b) Schering Bridge

Aim

To measure the unknown capacitance using Schering bridge.

Objective

- To measure the unknown capacitance.
- To study about dissipation factor.

Exercise

1. Design a bridge circuit for the given parameters.
2. Find the dissipation factor.
3. Fluid the unknown capacitance.

Equipment

i. Schering Bridge kit – 1 No
ii. Multimeter – 1 No
iii. Unknown capacitance – 1 No

3. DC Bridges

a) Wheat Stone Bridge

Aim

To measure the given medium resistance using Wheatstone Bridge.

Objective

- To study the working of bridge under balanced and unbalanced condition.
- To study the sensitivity of bridge.

Exercise

1. Design a bridge for the given parameters.
2. Find the unknown resistance.
3. Find the sensitivity of Bridge.

Equipment

i. Wheat stone Bridge kit – 1 No
ii. Unknown resistance – 1 No
iii. Multimeter – 1 No

b) Kelvin's Double bridge

Aim

To measure the given low resistance using Kelvin's double bridge method.

Objective

- To study the working of bridge under balanced and unbalance condition.
- To study the sensitivity of bridge.

Exercise

1. Design a bridge for the given parameters.
2. Find the unknown low resistance.
3. Find the sensitivity of bridge.

Equipment

i. Kelvin Double bridge kit – 1 No
ii. Unknown resistance – 1 No
iii. Multimeter – 1 No

4. Instrumentation Amplifier

Aim

To study the working of instrumentation amplifier.

Objective

- To study the characteristic of operational amplifier.
- To study the use of operational amplifier as instrumentation amplifier.

Exercise

1. Measure the output voltage for varying input voltage.
2. Calculate the output voltage theoretically.
3. Calculate the error.

Equipment

i.	Operational Amplifier	– 1 No
ii.	Resistors	– 1 No
iii.	RPS	– 1 No
iv.	Voltmeter	– 1 No
v.	Multimeter	– 1 No

5(a) A/D Converter

Aim

To design and test a 4 bit A/D converter Successive approximation type Ramp type

Objective

- To study the converstion of analog I/P voltage to digital o/p volage.
- To study the operation and characteristic of operational amplifier

Exercise

1. Given 4 bit analog input is converterd to digital output
2. Verify the practical output with theoretical output

Equipment

i.	IC 741	– 1 No
ii.	DC trainer kit	– 1 No
iii.	RPS	– 1 No
iv.	Resistor	– 1 No
v.	CRO	– 1 No

(b) D/A Converter

Aim

To design and test a 4 bit D/A converter Weighted resistor technique R-2R ladder network

Objective

- To study the conversion of binary voltage to analog o/p voltage
- To study the operation and characteristic of operational amplifier

Exercise

1. Given 4 bit binary input is converted to analog output
2. Verify the practical o/p with theoretical o/p

Experiment

i.	IC 741	– 1 No
ii.	DC Trainer kit	– 1 No
iii.	RPS	– 1 No
iv.	Resistor	– 1 No
v.	CRO	– 1 No

6. Study of Transients

Aim

To study the transient response of the given system

Objective

- To study the transient behaviour of the given system
- To study the effects of transients

Exercise

1. Draw the response curve for the given system
2. Find the time when the error is minimum

Equipment

i.	Resistance	– 1 No
ii.	Capacitance	– 1 No
iii.	RPS	– 1 No
iv.	Voltmeter	– 1 No
v.	Multimeter	– 1 No

7. Calibration of Single-Phase Energy Meter

Aim

To calibrate the given single phase energy meter at unity and other power factors

Objectives

- To study the working of energy meter
- Too accurately calibrate the meter at unity and other power factor
- To study the % of errors for the given energy meters

Exercise

1. Measure the experimental energy consumed
2. Calculate the theoretical energy
3. Calculate the percentage of error
4. Draw the calibration curve

Equipment

i.	Energy meter	– 1 No
ii.	Wattmeter	– 1 No
iii.	Stop watch	– 1 No
iv.	M.I Ammeter	– 1 No
v.	M.I Voltmeter	– 1 No

1. Calibration of Current Transformer

Aim

To study the working of current transformer

Objective

- To study the current transformation concept
- To study the efficiency of a given current transformer
- To study the loss components in the circuit

Exercise

1. Draw the curve primary current Vs secondary current
2. Observe the o/p for lamp load
3. Calculate the efficiency

Equipment

i.	Current Transformer	– 1 No
ii.	Lamp Load	– 1 No
iii.	Voltmeter	– 1 No
iv.	Ammeter	– 1 No

9. Measurement of 3 Phase Power And Power Factor

Aim

To conduct a suitable experiment on a 3-phase load connected in star or delta to measure the three phase power and power factor using 2 wattmeter method.

Objectives

- To study the working of wattmeter
- To accurately measure the 3 phase power
- To accurately measure the powerfactor
- To study the concept of star connected load and delta connected load

Exercise

1. Measure the real power, reactive power and power factor of 3 phase resistive inductive load.
2. Measure the real power, reactive power and power factor of 3 phase resistive capacitive load.

Equipment

i. 3 phase Auto transformer – 1 No
ii. M.I Ammeter – 1 No
iii. M.I Voltmeter – 1 No
iv. Wattmeter – 1 No

10. Measurement of Iron Loss (Maxwell Bridge)

Aim

To determine the iron losses in magnetic material using bridge method

Objective

- To study about hysterisis loss
- To study about eddy current loss

Exercise

1. Measure the current
2. Calculate iron loss
3. Calculate AC permeability
4. Draw phasor diagram

Equipment

i. Maxwell bridge set up – 1 No
ii. Ring specimen – 1 No
iii. Ammeter – 1 No
iv. Galvanometer – 1 No

SEMESTER IV
412EET01 - NUMERICAL METHODS
(Common to Civil, Aero & EEE)

AIM

With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically.

OBJECTIVES

At the end of the course, the students would be acquainted with the basic concepts in numerical methods and their uses are summarized as follows:

i. The roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.

ii. When huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.

iii. The numerical differentiation and integration find application when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.

iv. Since many physical laws are couched in terms of rate of change of one/two or more independent variables, most of the engineering problems are characterized in the form of either nonlinear ordinary differential equations or partial differential equations. The methods introduced in the solution of ordinary differential equations and partial differential equations will be useful in attempting any engineering problem.

1. SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

Solution of equation - Fixed point iteration: x=g(x) method – Newton's method – Solution of linear system by Gaussian elimination and Gauss-Jordon methods - Iterative methods - Gauss-Seidel methods - Inverse of a matrix by Gauss Jordon method – Eigen value of a matrix by power method and by Jacobi method for symmetric matrix.

2. INTERPOLATION AND APPROXIMATION

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulas.

3. NUMERICAL DIFFERENTIATION AND INTEGRATION

Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpsons's rules.

4. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

Single step methods: Taylor series method – Euler methods for First order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

5. BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

TEXT BOOKS

1. VEERARJAN,T and RAMACHANDRAN.T, 'NUMERICAL MEHODS with programming in 'C' Second Edition Tata McGraw Hill Pub.Co.Ltd, First reprint 2007.
2. SANKAR RAO K' NUMERICAL METHODS FOR SCIENTISITS AND ENGINEERS –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCE BOOKS

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, 'Numerical Methods', S.Chand Co. Ltd., New Delhi, 2003.
2. GERALD C.F. and WHEATE, P.O. 'APPLIED NUMERICAL ANALYSIS'… Edition, Pearson Education Asia, New Delhi.

412EET02 - ELECTRICAL MACHINES – I

AIM

To expose the students to the basic principles of Electro mechanical Energy Conversion in Electrical Apparatus and the operation of Transformers and DC Machines.

OBJECTIVES

i. To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
ii. To introduce the principles of electromechanical energy conversion in singly and multiply excited systems.
iii. 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.
iv. To study the working principles of DC machines as Generator and Motor, types, determination of their no-load/load characteristics, starting and methods of speed control of motors.
v. To estimate the various losses taking place in D.C. machines and to study the different testing methods to arrive at their performance.

1. INTRODUCTION

Electrical machine types – Magnetic circuits – Inductance – Statically and Dynamically induced EMF - Torque – Hysteresis- Core losses - AC operation of magnetic circuits.

2. TRANSFORMERS

Construction – principle of operation – equivalent circuit – losses – testing – efficiency and voltage regulation – auto transformer – three phase connections – parallel operation of transformers – tap changing.

3. ELECTROMECHANICAL ENERGY CONVERSION

Energy in magnetic systems – field energy, coenergy and mechanical force – singly and multiply excited systems.

4. BASIC CONCEPTS IN ROTATING MACHINES

Generated voltages in ac and dc machines, mmf of distributed windings – magnetic fields in rotating machines – rotating mmf waves – torque in ac and dc machines.

5. DC MACHINES

Construction – EMF and torque – circuit model – armature reaction – commutation – methods of excitation – characteristics of generators – characteristics of motors – starting and speed control – testing and efficiency – parallel operation.

TEXT BOOK

1. Nagrath I. J and Kothari D. P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 1990.
2. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, 2003.

REFERENCES

1. Fitzgerald.A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', McGraw Hill Books Company, 1992.
2. P. C. Sen., 'Principles of Electrical Machines and Power Electronics', John Wiley&Sons, 1997.
3. K. Murugesh Kumar, 'Electric Machines', Vikas publishing house Pvt Ltd, 2002.

408EET03 - POWER PLANT ENGINEERING

AIM

Expose the students to basics of various power plants so that they will have the comprehensive idea of power system operation.

OBJECTIVES

To become familiar with operation of various power plants.

1 THERMAL POWER PLANTS

Basic thermodynamic cycles, various components of steam power plant-layout-pulverized coal burners- Fluidized bed combustion-coal handling systems-ash handling systems- Forced draft and induced draft fans- Boilers-feed pumps-super heater- regenerator-condenser- deareators-cooling tower

2 HYDRO ELECTRIC POWER PLANTS

Layout-dams-selection of water turbines-types-pumped storage hydel plants

3 NUCLEAR POWER PLANTS

Principles of nuclear energy- Fission reactions-nuclear reactor-nuclear power plants

4 GAS AND DIESEL POWER PLANTS

Types, open and closed cycle gas turbine, work output & thermal efficiency, methods to improve performance-reheating, intercoolings, regeneration-advantage and disadvantages- Diesel engine power plant-component and layout

5 NON-CONVENTIONAL POWER GENERATION

Solar energy collectors, OTEC, wind power plants, tidal power plants and geothermal resources, fuel cell, MHD power generation-principle, thermoelectric power generation, thermionic power generation

TEXT BOOKS

1. A Course in Power Plant Engineering by Arora and Domkundwar, Dhanpat Rai and Co.Pvt.Ltd., New Delhi.
2. Power Plant Engineering by P.K. Nag, Tata McGraw Hill, Second Edition , Fourth reprint 2003.

REFERENCES

1. Power station Engineering and Economy by Bernhardt G.A.Skrotzki and William A. Vopat- Tata McGraw Hill Publishing Company Ltd., New Delhi, 20th reprint 2002.
2. An introduction to power plant technology by G.D. Rai-Khanna Publishers, Delhi-110 005.
3. Power Plant Technology, M.M. El-Wakil McGraw Hill 1984.

412EET04 - CONTROL SYSTEMS
(Common to EEE, EIE & ICE)

AIM

To provide sound knowledge in the basic concepts of linear control theory and design of control system.

OBJECTIVES

i To understand the methods of representation of systems and to desire their transfer function models.
ii To provide adequate knowledge in the time response of systems and steady state error analysis.
iii To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
iv To understand the concept of stability of control system and methods of stability analysis.
v To study the three ways of designing compensation for a control system.

1. 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.

2. 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 – P, PI, PID modes of feed back control.

3. 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.

4. STABILITY OF CONTROL SYSTEM

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

5. COMPENSATOR DESIGN

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots.

TEXT BOOKS

1. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.
2. Benjamin C. Kuo, Automatic Control systems, Pearson Education, New Delhi, 2003.

REFERENCE BOOKS

1. K. Ogata, 'Modern Control Engineering', 4th edition, PHI, New Delhi, 2002.
2. Norman S. Nise, Control Systems Engineering, 4th Edition, John Wiley, New Delhi, 2007.
3. Samarajit Ghosh, Control systems, Pearson Education, New Delhi, 2004
4. M. Gopal, 'Control Systems, Principles and Design', Tata McGraw Hill, New Delhi, 2002.

412EET05 - LINEAR INTEGRATED CIRCUITS AND APPLICATIONS
(Common to EEE, EIE & ICE)

AIM

To introduce the concepts for realizing functional building blocks in ICs, fabrications & application of ICs.

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.

1. 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.

2. CHARACTERISTICS OF OPAMP

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – summer, differentiator and integrator.

3. APPLICATIONS OF OPAMP

Instrumentation amplifier, first and second order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types.

4. SPECIAL ICs

555 Timer circuit – Functional block, characteristics & applications; 566-voltage controlled oscillator circuit; 565-phase lock loop circuit functioning and applications, Analog multiplier ICs.

5. APPLICATION ICs

IC voltage regulators - LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, ICL 8038 function generator IC, isolation amplifiers, opto coupler, opto electronic ICs.

TEXT BOOKS

1. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. (2000)
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.

REFERENCE BOOKS

1. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', Tata McGraw Hill, 2003.
2. Robert F.Coughlin, Fredrick F.Driscoll, 'Op-amp and Linear ICs', Pearson Education, 4th edition, 2002 / PHI.
3. David A.Bell, 'Op-amp & Linear ICs', Prentice Hall of India, 2nd edition, 1997

412EET06 - DIGITAL LOGIC CIRCUITS

AIM

To introduce the fundamentals of Digital Circuits, combinational and sequential circuit.

OBJECTIVES

- To study various number systems and to simplify the mathematical expressions using Boolean functions – simple problems.
- To study implementation of combinational circuits
- To study the design of various synchronous and asynchronous circuits.
- To expose the students to various memory devices.
- To introduce digital simulation techniques for development of application oriented logic circuit.

1. BOOLEAN ALGEBRA AND COMBINATIONAL CIRCUITS

Boolean algebra: De-Morgan's theorem, switching functions and simplification using K-maps & Quine McCluskey method, Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers.

2. SYNCHRONOUS SEQUENTIAL CIRCUITS

Flip flops - SR, D, JK and T. Analysis of synchronous sequential circuits; design of synchronous sequential circuits – Counters, state diagram; state reduction; state assignment.

3. ASYNCHRONOUS SEQUENCTIAL CIRCUIT

Analysis of asynchronous sequential machines, state assignment, asynchronous design problem.

4. PROGRAMMABLE LOGIC DEVICES, MEMORY AND LOGIC FAMILIES

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA, digital logic families: TTL, ECL, CMOS.

5. VHDL

RTL Design – combinational logic – Types – Operators – Packages – Sequential circuit – Sub programs – Test benches. (Examples: adders, counters, flipflops, FSM, Multiplexers / Demltiplexers).

TEXT BOOKS

1. Raj Kamal, ' Digital systems-Principles and Design', Pearson education 2nd edition, 2007
2. M. Morris Mano, 'Digital Design', Pearson Education, 2006.
3. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 2002.

REFERENCES

1. Charles H.Roth, 'Fundamentals Logic Design', Jaico Publishing, IV edition, 2002.
2. Floyd and Jain, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
3. John F.Wakerly, 'Digital Design Principles and Practice', 3rd edition, Pearson Education, 2002.
4. Tocci, "Digital Systems : Principles and aopplications, 8th Edition" Pearson Education.

412EEP01 - CONTROL SYSTEM LABORATORY

1. Determination of transfer function of DC Servomotor
2. Determination of transfer function of AC Servomotor.
3. Analog simulation of Type - 0 and Type – 1 systems
4. Determination of transfer function of DC Generator
5. Determination of transfer function of DC Motor
6. Stability analysis of linear systems
7. DC and AC position control systems
8. Stepper motor control system
9. Digital simulation of first systems
10. Digital simulation of second systems

Detailed Syllabus

1. Determination of Transfer Function Parameters of a DC Servo Motor

Aim

To derive the transfer function of the given D.C Servomotor and experimentally determine the transfer function parameters

Exercise

1. Derive the transfer function from basic principles for a separately excited DC motor.
2. Determine the armature and field parameters by conducting suitable experiments.
3. Determine the mechanical parameter by conducting suitable experiments.
4. Plot the frequency response.

Equipment

i.	DC servo motor	: field separately excited – loading facility – variable voltage source - 1 No
ii.	Tachometer	: 1 No
iii.	Multimeter	: 2 Nos
iv.	Stop watch	: 1 No

2. Determination of Transfer Function Parameters of AC Servo Motor

Aim

To derive the transfer function of the given A.C Servo Motor and experimentally determine the transfer function parameters

Exercise

1. Derive the transfer function of the AC Servo Motor from basic Principles.
2. Obtain the D.C gain by operating at rated speed.
3. Determine the time constant (mechanical)
4. Plot the frequency response

Equipment

i.	AC Servo Motor	: Minimum of 100w – necessary sources for main winding and control winding – 1 No
ii.	Tachometer	: 1 No
iii.	Stopwatch	: 1 No
iv.	Voltmeter	: 1 No

3. Analog Simulation Of Type-0 And Type-1 System

Aim

To simulate the time response characteristics of I order and II order, type 0 and type-1 systems.

Exercise

1. Obtain the time response characteristics of type – 0 and type-1, I order and II order systems mathematically.
2. Simulate practically the time response characteristics using analog rigged up modules.
3. Identify the real time system with similar characteristics.

Equipment

i. Rigged up models of type-0 and type-1 system using analog components.
ii. Variable frequency square wave generator and a normal CRO - 1 No

(or)

DC source and storage Oscilloscope - 1 No

4. Determination of Transfer function of DC Generator

Aim

To determine the transfer function of DC generator

Exercise

1. Obtain the transfer function of DC generator by calculating τ and gain

Equipment

i. DC Generator
ii. Tachometer
iii. Various meters
iv. Stop watch

5. Determination of Transfer function of DC Motor

Aim

To determine the transfer function of DC motor

Exercise

1. Obtain the transfer function of DC motor by calculating τ and gain

Equipment

i. DC Motor
ii. Tachometer
iii. Various meters
iv. Stop watch

6. Stability Analysis of Linear Systems

Aim

To analyse the stability of linear systems using Bode / Root locus / Nyquist plot

Exercise

1. Write a program to obtain the Bode plot / Root locus / Nyquist plot for the given system
2. Access the stability of the given system using the plots obtained
3. Compare the usage of various plots in assessing stability

Equipment

- System with MATLAB / MATHCAD / equivalent software - 3 user license

7. DC and AC position Control system

Aim

To study the AC and DC position control system and draw the error characteristics between setpoint and error.

Exercise

1. To study various positions and calculate the error between setpoint and output. position
2. To measure outputs at various points (between stages)

Equipment

i. AC and DC position control kit with DC servo motor.
ii. Power transistor
iii. Adder

8. Stepper Motor Control System

Aim

To study the working of stepper motor

Exercise

1. To verify the working of the stepper motor rotation using microprocessor**.**

Equipment

i. Stepping motor
ii. Microprocessor kit
iii. Interfacing card
iv. Power supply

9. Digital Simulation of First order System

Aim

To digitally simulate the time response characteristics of first -order system

Exercise

1. Write a program or build the block diagram model using the given software.
2. Obtain the impulse, step and sinusoidal response characteristics.
3. Identify real time systems with similar characteristics.

Equipment

1. System with MATLAB / MATHCAD (or) equivalent software - minimum 3 user license.

10. Digital Simulation of Second order Systems

Aim

To digitally simulate the time response characteristics of second -order system

Exercise

1. Write a program or build the block diagram model using the given software.
2. Obtain the impulse, step and sinusoidal response characteristics.
3. Identify real time systems with similar characteristics.

Equipment

i. System with MATLAB / MATHCAD (or) equivalent software - minimum 3 user license.

412EEP02 - LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY
(Common to EEE, EIE & ICE)

AIM

To study various digital & linear integrated circuits used in simple system configuration.

1. Study of Basic Digital IC's. (Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND, JK FF, RS FF, D FF)
2. Implementation of Boolean Functions, Adder/ Subtractor circuits.
3. (i) Code converters, Parity generator and parity checking, Excess-3, 2s Complement, Binary to Gray code using suitable IC's .
   (i) Encoders and Decoders: Decimal and Implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
4. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
5. Shift Registers:
   Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
6. Multiplex/ De-multiplex:
   Study of 4:1; 8:1 multiplexer and Study of 1:4; 1:8 demultiplexer
7. Timer IC application:
   Study of NE/SE 555 timer in Astable, Monostable operation.
8. Application of Op-Amp:
   Slew rate verifications, inverting and non-inverting amplifier, Adder, comparator, Integrater and Differentiator.
9. Study of Analog to Digital Converter and Digital to Analog Converter: Verification of A/D conversion using dedicated IC's.
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.

Detailed Syllabus

1. Study of Basic Digital IC's.
(Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND, JK FF, RS FF, D FF)

Aim

To test of ICs by using verification of truth table of basic ICs.

Exercise

Breadboard connection of ICs with truth table verification using LED's.

2. Implementation of Boolean Functions, Adder/ Subtractor circuits.
[Minimizations using K-map and implementing the same in POS, SOP from using basic gates]

Aim

Minimization of functions using K-map implementation and combination Circuit.

Exercise

(i) Realization of functions using SOP, POS, form.
(ii) Addition, Subtraction of atleast 3 bit binary number using basic gate IC' s.

3. (a)Code converters, Parity genertor and parity checking, Excess 3, 2s Complement,
Binary to grey code using suitable ICs .

Aim
Realizing code conversion of numbers of different bar.

Exercise
- Conversion Binary to Grey, Grey to Binary;
- 1's. 2's complement of numbers addition, subtraction,
- Parity checking of numbers using Gates and with dedicated IC's

(b)Encoders and Decoders: Decimal and Implementation of 4-bit shift registers in SISO, SIPO,PISO,PIPO modes using suitable ICs.

Exercise
(i) Decimal to binary Conversion using dedicated ICs.
(ii) BCD – 7 Segment display decoder using dedicated decoder IC& display.

4. Counters: Design and implementation of 4-bit modulo counters as synchronous
and asynchronous types using FF IC's and specific counter IC.

Aim
Design and implementation of 4 bit modulo counters.

Exercise
1. Using flipflop for up-down count synchronous count.
2. Realization of counter function using dedicated ICs.

5. Shift Registers:
Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.

Aim
Design and implementation of shift register.

Exercise
1. Shift Register function realization of the above using dedicated IC's For SISO, SIPO, PISO, PIPO, modes of atleast 3 bit binary word.
2. Realization of the above using dedicated IC's.

6. Multiplex/ De-multiplex.
Study of 4:1; 8:1 multiplexer and Study of 1:4; 1:8 demultiplexer

Aim
To demonstrate the addressing way of data channel selection for multiplex De-multiplex operation.

Exercise
1. Realization of mux-demux functions using direct IC's.
2. Realization of mux-demux using dedicated IC's for 4:1, 8:1, and vice versa.

7. Timer IC application. Study of NE/SE 555 timer in Astable, Monostable operation.

Aim

To design a multi vibrater circuit for square wave and pulse generation.

Exercise

1. Realization of Astable multivibrater & monostable multivibrater circuit using Timer IC.
2. Variation of R, C, to vary the frequency, duty cycle for signal generator.

8. Application of Op-Amp-I

Slew rate verifications, inverting and non-inverting amplifier,
Adder, comparator, Integrater and Differentiator.

Aim

Design and Realization of Op-Amp application.

Exercise

1. Verification of Op-Amp IC characteristics.
2. Op-Amp IC application for simple arithmetic circuit.
3. Op-Amp IC application for voltage comparator wave generator and wave shifting circuits.

9. Study of Analog to Digital Converter and Digital to Analog Converter: Verification of A/D conversion using dedicated IC's.

Aim

Realization of circuit for digital conversions.

Exercise

1. Design of circuit for analog to digital signal conversion using dedicated IC's.
2. Realization of circuit using dedicated IC for digital analog conversion.

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.

Aim

Demonstration of circuit for communication application

Exercise

1. To realize V/F conversion using dedicated IC's vary the frequency of the generated signal.
2. To realize PLL IC based circuit for frequency multiplier, divider.

Requirement for a batch of 30 students

S.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Interface such as, A/D, D/A converter, DMA, PIC Serial, Interface, Temperatures controller, Stepper motor, Key board	4 each		
2.	CRO and function generator	3 each		
3.	IC trainer Kit	15		
4.	Analog AC trainer kit	4		
5.	Components and bread boards	10 each		
6.	Chips IC – 7400	10		
7.	Chips IC – 7402	10		
8.	Chips IC – 7408	10		
9.	Chips IC – 7432	10		
10.	Chips IC – 7410	25		
11.	Chips IC – 555	10		
12.	Chips IC – 741	10		
13.	Chips IC – 74153	10		
14.	Chips IC – 7474	10		
15.	Chips IC – 7490	10		
16.	Chips IC – 7447	10		
17.	Chips IC – 7476	10		
18.	Chips IC – 7420	10		
19.	Chips IC – 7404	15		
20.	Chips LM – 317	10		
21.	Chips LM – 723	10		
22.	Chips MA – 7840	10		

S.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
23.	Chips LM – 380	10		
24.	Chips ICL - 8038	10		
25.	Traffic light control kit	2		
26.	VDU	2		
27.	7 segment Display	5		
28.	Interfacing card such as keyboard etc.	3 each		
29.	Work tables	15		

412EEP03 - ELECTRICAL MACHINES LABORATORY – I

AIM

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

1. Open circuit and load characteristics of separately and self excited DC shunt generators.
2. Load characteristics of DC compound generator with differential and cumulative connection.
3. Load characteristics of DC shunt and compound motor.
4. Load characteristics of 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 transformer connections.
8. Open circuit and short circuit tests on single phase transformer.
9. Sumpner's test on transformers.
10. Separation of no-load losses in single phase transformer.

Requirement for a batch of 30 students

S.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	D.C motor – Generator set D.C motor – Shunt Generator D.C motor – Compound Generator	 2 set 2 set		
2.	D.C. Shunt Motor	2 Nos.		
3.	D.C. Series Motor	1 No.		
4.	D.C. Compound Motor	1 No.		
5.	Single phase transformers	7 Nos.		
6.	Three phase transformers	2 Nos.		
7.	D.C. Motor – Alternator set	4 sets		
8.	Three phase Induction Motor (Squirrel cage)	3 Nos.		
9.	Three phase slip ring Induction Motor	1 No.		
10.	Single phase Induction Motor	2 Nos.		
11.	Resistive load 3 phase – 2 , single phase - 3	5 Nos.		
12.	Inductive load	1 No.		
13.	Single phase Auto transformer	5 Nos.		
14.	Three phase Auto transformer	3 Nos.		
15.	Moving Coil Ammeter of different ranges	20 Nos.		
16.	Moving Coil Voltmeter of different ranges	20 Nos.		
17.	Moving Iron Ammeter of different ranges	20 Nos.		
18.	Moving Iron voltmeter of different ranges	20 Nos.		

19.	Wire wound Rheostats of different ratings	30 Nos.		
20.	Tachometers	10 Nos.		
21.	Single element wattmeters of different ranges UPF / LPF	20 Nos.		
22.	Double element wattmeters of different ranges	4 Nos.		
23.	Power factor meter	2 Nos.		
24.	Digital multimeter	5 Nos.		
25.	Three point starter, four point starter,DOL starter, manual star / delta starter, semi automatic and fully automatic star / delta starter	1 No each for study experiment		

FIFTH SEMESTER

512EET01 - COMMUNICATION ENGINEERING

AIM

To introduce the concepts of communication systems engineering using wire and wireless medium

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 theorum, BW – SNR trade off codes: NRZ, RZ, AMI, HDBP, ABQ, MBnB codes : 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

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.

512EET02 - DIGITAL SIGNAL PROCESSING

AIM

To introduce the concept of analyzing discrete time signals & systems in the time and frequency domain.

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. Digital signal representation.

UNIT II DISCRETE TIME SYSTEM ANALYSIS

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Fourier transform of discrete sequence – Discrete Fourier series.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – 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. IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping – Frequency transformation.

UNIT V DIGITAL SIGNAL PROCESSORS

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

TEXT BOOKS

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 2003 / PHI.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, New Delhi, 2001.

REFERENCES

1. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time Signal Processing', Pearson Education, New Delhi, 2003.
2. Emmanuel C Ifeachor and Barrie W Jervis ,"Digital Signal Processing – A Practical approach" Pearson Education, Second edition, 2002.
3. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", Second Edition, California Technical Publishing San Diego, California. w.DSPguide.com)
4. B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003.

512EET03 - OBJECT ORIENTED PROGRAMMING

AIM

To understand the concepts of object-oriented programming and master OOP using C++ and Java.

UNIT I

Object oriented programming concepts – objects-classes- methods and messagesabstraction and encapsulation-inheritance- abstract classes- polymorphism. Introduction to C++- objects-classes-constructors and destructors

UNIT II

Operator overloading - friend functions- type conversions- templates - Inheritance – virtual functions- runtime polymorphism.

UNIT III

Exception handling - Streams and formatted I/O – file handling – namespaces – String Objects - standard template library.

UNIT IV

Introduction to JAVA , bytecode, virtual machines – objects – classes – Javadoc – packages – Arrays - Strings

UNIT V

Inheritance – interfaces and inner classes - exception handling – threads - Streams and I/O.

TEXT BOOKS

1. B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.
2. Cay S. Horstmann, Gary Cornell, "Core JAVA volume 1", Eighth Edition, Pearson Education, 2008.

REFERENCES

1. ISRD Group, "Introduction to Object-oriented Programming and C++", Tata McGraw- Hill Publishing Company Ltd., 2007.
2. ISRD Group, "Introduction to Object-oriented programming through Java", Tata McGraw-Hill Publishing Company Ltd., 2007.
3. S. B. Lippman, Josee Lajoie, Barbara E. Moo, "C++ Premier", Fourth Edition, Pearson Education, 2005.
4. D. S. Malik, "C++ Programming: From Problem Analysis to Program Design", Third Edition, Thomson Course Technology, 2007.
5. K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000.
6. C. Thomas Wu, "An introduction to Object-oriented programming with Java", Fourth Edition, Tata McGraw-Hill Publishing Company Ltd., 2006.

512EET04 - POWER ELECTRONICS

AIM

Learning how to apply the electronic devices for conversion, control and conditioning of electronic power.

OBJECTIVES

- To get an overview of different types of power semi-conductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basic topologics of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand the harmonic reduction methods.
- To study the operation of AC voltage controller and Matrix converters.
- To study simple applications

UNIT I POWER SEMI-CONDUCTOR DEVICES

Study of switching devices, - Frame, Driver and snubber circuit of SCR, TRIAC, BJT, IGBT, MOSFET,- Turn-on and turn-off characteristics, switching losses, Commutation circuits for SCR,

UNIT II PHASE-CONTROLLED CONVERTERS

2-pulse, 3-pulse and 6-pulse converters – Effect of source inductance – performance parameters – Reactive power control of cnverters – Dual converters – Battery charger.

UNIT III DC TO DC CONVERTER

Step-down and step-up chopper - Time ratio control and current limit control – Buck, boost, buck-boost converter, concept of Resonant switching - SMPS.

UNIT IV INVERTERS

Single phase and three phase (both 1200 mode and 1800 mode) inverters – PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulations - Voltage and harmonic control - Series resonant inverter - Current source inverter.

UNIT V AC TO AC CONVERTERS

Single phase AC voltage controllers – Multistage sequence control - single and three phase cycloconverters –Introduction to Integral cycle control, Power factor control and Matrix converters.

TEXT BOOKS

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third edition, New Delhi 2004.
2. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.

REFERENCES

1. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition 2003.
3. Ned Mohan, Tore.M.Undeland, William.P.Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.

512EET05 - ELECTRICAL MACHINES - II

AIM

To expose the students to the concepts of synchronous and asynchronous machines and analyze their performance.

OBJECTIVES

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

UNIT I SYNCHRONOUS GENERATOR

Constructional details – Types of rotors – emf equation – Synchronous reactance – Armature reaction – Voltage regulation – EMF, MMF, ZPF and A.S.A methods – Synchronizing and parallel operation – Synchronizing torque - Change of excitation and mechanical input – Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test – Operating characteristics - Capability curves.

UNIT II SYNCHRONOUS MOTOR

Principle of operation – Torque equation – Operation on infinite bus bars - V-curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed.

UNIT III THREE PHASE INDUCTION MOTOR

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

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR

Need for starting – Types of starters – Rotor resistance, Autotransformer and Star-delta starters – Speed control – Change of voltage, torque, number of poles and slip – Cascaded connection – Slip power recovery scheme.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES

Constructional details of single phase induction motor – Double revolving field theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors - Shaded pole induction motor - Linear reluctance motor - Repulsion motor - Hysteresis motor - AC series motor.

TEXT BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.
2. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.

REFERENCES

1. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', Tata McGraw Hill publishing Company Ltd, 2003.
2. J.B. Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons, 2002.
3. K. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt Ltd, 2002.

512EET06 - TRANSMISSION AND DISTRIBUTION

AIM

To understand the importance and the functioning of transmission and distribution of electric power in an electrical utility (or) a power system.

OBJECTIVES

i. To develop expressions for the computation of transmission line parameters.
ii. 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.
iii. To analyses the voltage distribution in insulator strings and cables and methods to improve the same.
iv. To understand the operation of the different distribution schemes.

UNIT I INTRODUCTION

Structure of electric power system - different operating voltages of generation, transmission and distribution-advantage of higher operating voltage for AC transmission. An introduction to EHV AC transmission, HVDC transmission and FACTs. Mechanical design of transmission line between towers – sag and tension calculations using approximate equations taking into account the effect of ice and wind.

UNIT II TRANSMISSION LINE PARAMETERS

Parameters of resistance, inductance and capacitance calculations - single and three phase transmission lines - single and double circuits - solid, stranded and bundled conductors - symmetrical and unsymmetrical spacing – transposition of lines – concepts of GMR and GMD - skin and proximity effects - interference with neighbouring communication circuits. Corona discharge characteristics – critical voltage and loss. (Simple diagrams of typical towers and conductors for 400, 220 and 110 kV operations)

UNIT III MODELLING AND PERFORMANCE OF TRANSMISSION LINES

Transmission line classification - short line, medium line and long line – equivalent circuits – Ferranti effect - surge impedance, attenuation constant and phase constant - voltage regulation and transmission efficiency - real and reactive power flow in lines – power circle diagrams – shunt and series compensation. An introduction to power angle diagram - surge-impedance loading, loadability limits based on thermal loading; angle and voltage stability considerations.

UNIT IV INSULATORS AND CABLES

Classification of insulators for transmission and distribution purpose – voltage distribution in insulator string and grading - improvement of string efficiency. Underground cables - constructional features of LT and HT cables – insulation resistance, capacitance, dielectric stress and grading – tan δ and power loss – thermal characteristics.

UNIT V SUBSTATION, GROUNDING SYSTEM AND DISTRIBUTION SYSTEM

Classification, functions and major components of substations. Bus-bar arrangements - substation bus schemes - single bus, double bus with double breaker, double bus with single breaker, main and transfer bus, ring bus, breaker-and-ahalf with two main buses, double bus-bar with bypass isolators. Importance of earthing in a substation. Qualitative treatment to neutral grounding and earthing practises in substations. Feeders, distributors and service mains. DC distributor – 2-wire and 3-wire, radial and ring main distribution. AC distribution– single phase and three phase 4-wire distribution. .

TEXT BOOKS

1. B.R.Gupta, 'Power System Analysis and Design', S. Chand, New Delhi, 2003.
2. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, 2002.

REFERENCES

1. Luces M. Fualkenberry, Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.
2. Hadi Saadat, 'Power System Analysis,' Tata McGraw Hill Publishing Company', 2003.
3. Central Electricity Authority (CEA), 'Guidelines for Transmission System Planning', New Delhi.
4. 'Tamil Nadu Electricity Board Handbook', 2003.

512EEP01 - OBJECT- ORIENTED PROGRAMMING LAB

Aim:
To develop object-oriented programming skills using C++ and Java

1. Function overloading, default arguments in C++
2. Simple class design in C++, namespaces, objects creations
3. Class design in C++ using dynamic memory allocation, destructor, copy Constructor.
4. Operator overloading, friend functions
5. Overloading assignment operator, type conversions
6. Inheritance, run-time polymorphism
7. Template design in C++
8. I/O, Throwing and Catching exceptions
9. Program development using STL
10. Simple class designs in Java with Javadoc
11. Designing Packages with Javadoc comments
12. Interfaces and Inheritance in Java
13. Exceptions handling in Java
14. Java I/O
15. Design of multi-threaded programs in Java

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity required
	Hardware required	
1.	Computers (Pentium-4)	40 Nos. with one server
2.	Dot matrix printer	3 Nos.
3.	Laser Printer	2 Nos.
4.	UPS (5 KVA)	
	Software Required	
5.	Turbo C++	40 Nodes
6.	(Java 2 SDK) JDK 5.0 update 6(1.5.0-Internal Version No.)	40 Nos.

512EEP02 - POWER ELECTRONICS LABORATORY

AIM

To study the characteristics of switching devices and its applications in rectifier inverter, chopper and resonant converter.

List of experiments with objectives and exercises

1. Characteristics of SCR
2. Characteristics of TRIAC
3. Characteristics of MOSFET and IGBT
4. Transient characteristics of SCR and MOSFET
5. AC to DC fully controlled converter
6. AC to DC half-controlled converter
7. Step down and step up MOSFET based choppers
8. IGBT based single-phase PWM inverter
9. IGBT based three-phase PWM inverter
10. Resonant dc-to-dc converter

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity required
1.	Device characteristics (for SCR, MOSFET, TRIAC and IGBT) kit with built in power supply & meters	2 each
2.	SCR firing circuit module	2
3.	Single phase SCR based ½ controlled converter & fully controlled converter along with built-in / separate / firing circuit / module and meter	2 each
4.	MOSFET based step up and step down choppers	1 each
5.	IGBT based single phase PWM inverter module	2
6.	IGBT based three phase PWM inverter module	2
7.	IGBT based high switching frequency chopper module with built-in controller.	2
8.	Resonant DC-DC conveter module with built in power supply and controller	2
9.	SCR & TRIAC based 1 phase A.C.phase controller along with lamp or rheostat load	4
10.	SCR based V/I commuted chopper module with relevant firing module (separate or built-in)	4
11.	Dual regulated DC power supply with common ground	4
12.	Cathode Ray Oscilloscope	5
13.	Isolation Transformer	5
14.	Single phase Auto transformer	3
15.	Components (Inductance, Capacitance)	3 sets for each
16.	Multi meter	5
17.	LCR meter	3
18.	Rheostats of various ranges	2 sets of 10 value
19.	Work tables	12
20.	DC and AC metes of required ranges	20

512EEP03 - ELECTRICAL MACHINES II LABORATORY

AIM

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

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.
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.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity required
1.	DC shunt motor coupled three phase alternator	2
2.	Synchronous motor coupled to DC motor	1
3.	Three phase induction motors – Squirrel cage Slip ring	 2 1
4.	DC Shunt motor coupled salient pole three phase alternator	1
5.	Single phase induction motors	2
6.	Inductive board	1
7.	Starter- Three phase induction motor starters Single phase induction motor starters	 1 1
8.	Meters- Voltmeter (AC) Ammeter (AC) Wattmeter (Ipf) Wattmeter (upf)	 15 15 15 30
9.	Single phase auto transformer	2
10.	Three phase auto transformer	4
11.	Rheostats of various range	30
12.	DC panel boards (220V, 36V)	1 each
13.	AC panel board	1
14.	Work tables	12

SIXTH SEMESTER
612EET01 - POWER SYSTEM ANALYSIS

AIM

To understand the necessity and to become familiar with the modelling of power system and components. And to apply different methods to analyse power system for the purpose of system planning and operation.

OBJECTIVES

- To model the power system under steady state operating condition. To apply efficient numerical methods to solve the power flow problem.
- To model and analyse the power systems under abnormal (or) fault conditions.
- To model and analyse the transient behaviour of power system when it is subjected to a fault.

UNIT I INTRODUCTION

Modern power system (or) electric energy system - Analysis for system planning and operational studies – basic components of a power system. Generator models - transformer model – transmission system model - load representation. Single line diagram – per phase and per unit representation – change of base. Simple building algorithms for the formation of Y-Bus matrix and Z-Bus matrix.

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 into P-Q buses, P-V (voltagecontrolled) buses and slack bus. Development of Power flow model in complex variables form and polar variables form. Iterative solution using Gauss-Seidel method including Q-limit check for voltagecontrolled buses – algorithm and flow chart. Iterative solution using Newton-Raphson (N-R) method (polar form) including Q-limit check and bus switching for voltage-controlled buses - Jacobian matrix elements – algorithm and flow chart. Development of Fast Decoupled Power Flow (FDPF) model and iterative solution – algorithm and flowchart; Comparison of the three methods.

UNIT III FAULT ANALYSIS – BALANCED FAULTS

Importance short circuit (or) for fault analysis - basic assumptions in fault analysis of power systems. Symmetrical (or) balanced three phase faults – problem formulation – fault analysis using Z-bus matrix – algorithm and flow chart. Computations of short circuit capacity, post fault voltage and currents.

UNIT IV FAULT ANALYSIS – UNBALANCED FAULTS

Introduction to symmetrical components – sequence impedances – sequence networks – representation of single line to ground, line to line and double line to ground fault conditions. Unbalanced fault analysis - problem formulation – analysis using Z-bus impedance matrix – (algorithm and flow chart.).

UNIT V STABILITY ANALYSIS

Importance of stability analysis in power system planning and operation - classification of power system stability - angle and voltage stability – simple treatment of angle stability into small-signal and large-signal (transient) stability Single Machine Infinite Bus (SMIB) system: Development of swing equation - equal area criterion - determination of critical clearing angle and time by using modified Euler method and Runge-Kutta second order method. Algorithm and flow chart.

TEXT BOOKS

1. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Publishing Company, New Delhi, 2002.
2. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Limited, New Delhi, Second Edition, 2003.

REFERENCES

1. P. Kundur, 'Power System Stability and Control, Tata McGraw Hill, Publications, 1994.
1. John J. Grainger and W.D. Stevenson Jr., 'Power System Analysis', McGraw Hill International Book Company, 1994.
3. I.J. Nagrath and D.P. Kothari, 'Modern Power System Analysis', Tata McGraw-Hill Publishing Company, New Delhi, 1990.
4. K.Nagasarkar and M.S. Sukhija Oxford University Press, 2007.

612EET02 - SOLID STATE DRIVES

AIM

To study and understand the operation of electric drives controlled from a power electronic converter and to introduce the design concepts of controllers.

OBJECTIVES

- To understand the stable steady-state operation and transient dynamics of a motorload system.
- To study and analyze the operation of the converter / chopper fed dc drive and to solve simple problems.
- To study and understand the operation of both classical and modern induction motor drives.
- To understand the differences between synchronous motor drive and induction motor drive and to learn the basics of permanent magnet synchronous motor drives.
- To analyze and design the current and speed controllers for a closed loop solid-state DC motor drive and simulation using a software package.

UNIT I DRIVE CHARACTERISTICS

Equations governing motor load dynamics - steady state stability - Multi quadrant dynamics - Acceleration, deceleration, starting and stopping - load torque characteristics of various drives.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE

Steady state analysis of the single and three phase fully controlled converter fed separately excited D.C motor drive - Continuous and discontinuous conduction Time ratio and current limit control - 4 quadrant operation of converter.

UNIT III 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 control, Design of controllers: Current controller and speed controller - Converter selection and characteristics - Use of simulation software package.

UNIT IV INDUCTION MOTOR DRIVES

Stator voltage control – energy efficient drive - v/f control, constant air-gap flux – field weakening mode - voltage/current fed inverters - Block diagram of vector control - closed loop control.

UNIT V SYNCHRONOUS MOTOR DRIVES

V/f control and self-control of synchronous motor – Marginal angle control and power factor control - Permanent magnet synchronous motor Black diagram of closed loop control.

TEXT BOOKS

1. Gopal K.Dubey, "Power Semi conductor controlled drives " Prentice Hall Inc., New Jersey 1989.
2. Bimal K. Bose. 'Modern Power Electronics and AC Drives', PHI / Pearson Education, 2002.

REFERENCES:

1. N.K.De and S.K.Sen Electrical Drices" PHI, 2006 9th print.
2. Murphy J.M.D. and Turnbull, " Thyristor control of AC Motor" Pergamon Press Oxford 1988.
3. R. Krishnan, 'Electric Motor & Drives Modeling, Analysis and Control', Prentice Hall of India, 2001.

612EET03 - HIGH VOLTAGE ENGINEERING

AIM

To expose the students to various types of over voltage transients in power system and its effect on power system.

- Generation of over voltages in laboratory.
- Testing of power apparatus and system.

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 over voltages – protection against over voltages – Bewley's lattice diagram.

UNIT II ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS

Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids – 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. Tripping and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS

Measurement of High voltages and High currents – Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION

High voltage testing of electrical power apparatus – Power frequency, impulse voltage and DC testing – International and Indian standards – Insulation Coordination.

TEXT BOOK

1. M. S. Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, 3rd Edition, 2004.
2. E. Kuffel and M. Abdullah, 'High Voltage Engineering', Pergamon Press, Oxford, 1970.

REFERENCES

1. E. Kuffel and W. S. Zaengel, 'High Voltage Engineering Fundamentals', Pergamon Press, Oxford, London, 1986.
2. L. L. Alston, Oxford University Press, New Delhi, First Indian Edition, 2006.

612EET04 - MICROPROCESSORS AND MICROCONTROLLER

AIM

To introduce Microprocessor Intel 8085 and 8086 and the Micro Controller 8051

OBJECTIVES

- To study the Architecture of 8085 & 8086, 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 program writing for 8051 & 8085 and applications
- To introduce commonly used peripheral / interfacing ICs

UNIT I 8085 and 8086 PROCESSOR

Hardware Architecture pintouts - Signals – Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupt structure.

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 PERIPHERAL INTERFACING

Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter – Interfacing with 8085 - A/D and D/A converter interfacing.

UNIT IV 8051 MICRO CONTROLLER

Functional block diagram - Instruction format and addressing modes – Timing Diagram Interrupt structure – Timer –I/O ports – Serial communication.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS

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

TEXT BOOKS

1. "Microprocessor and Microcontrollers", Krishna Kant Eastern Company Edition, Prentice – Hall of India, New Delhi , 2007.
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCES

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', Wiley Eastern Ltd., New Delhi.
2. The 8088 & 8086 Microprocessors , Walter A Tribal & Avtar Singh, Pearson, 2007, Fourth Edition.

612EET05 - DESIGN OF ELECTRICAL MACHINES

AIM

To expose the students to the concept of design of various types of electrical machines.

OBJECTIVES

- To provide sound knowledge about constructional details and design of various electrical machines.
- 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 - Rating of machines – Standard specifications.

UNIT II DC MACHINES

Output Equations – Main Dimensions - Magnetic circuit 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 – Overall dimensions – Operating characteristics – Regulation – 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 – 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 – Circle diagram - Operating characteristics.

UNIT V SYNCHRONOUS MACHINES

Output equations – choice of loadings – 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.

TEXT BOOKS

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.
2. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

REFERENCES

1. A.Shanmugasundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age Intenational Pvt. Ltd., Reprint 2007.
2. 'Electrical Machine Design', Balbir Singh, Brite Publications, Pune.

612EET06 - COMPUTER NETWORKS

UNIT I

Introduction to networks – network architecture – network performance – Direct link networks – encoding – framing – error detection – transmission – Ethernet – Rings – FDDI - Wireless networks – Switched networks – bridges

UNIT II

Internetworking – IP - ARP – Reverse Address Resolution Protocol – Dynamic Host Configuration Protocol – Internet Control Message Protocol – Routing – Routing algorithms – Addressing – Subnetting – CIDR – Inter domain routing – IPv6

UNIT III

Transport Layer – User Datagram Protocol (UDP) – Transmission Control Protocol – Congestion control – Flow control – Queuing Disciplines – Congestion – Avoidance Mechanisms.

UNIT IV

Data Compression – introduction to JPEG, MPEG, and MP3 – cryptography – symmetric-key – public-key – authentication – key distribution – key agreement – PGP – SSH – Transport layer security – IP Security – wireless security – Firewalls.

UNIT V

Domain Name System (DNS) – E-mail – World Wide Web (HTTP) – Simple Network Management Protocol – File Transfer Protocol (FTP) – Web Services - Multimedia Applications – Overlay networks

TEXT BOOK:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", Fourth Edition, Elsevier Publishers Inc., 2007.
2. Andrew S. Tanenbaum, "Computer Networks", Fourth Edition, PHI, 2003.

REFERENCES:

1. James F. Kuross and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Third Edition, Addision wesley, 2004.
2. William Stallings, "Data and Computer Communication", Sixth Edition, Pearson Education, 2000.
3. Nader F. Mir, "Computer and communication networks", Pearson Education, 2007.

ELECTIVE I
612EET07 - FIBRE OPTICS AND LASER INSTRUMENTS

AIM

To contribute to the knowledge of Fibre optics and Laser Instrumentation and its Industrial and Medical Application.

OBJECTIVES

- To expose the students to the basic concepts of optical fibres and their properties.
- To provide adequate knowledge about the Industrial applications of optical fibres.
- To expose the students to the Laser fundamentals.
- To provide adequate knowledge about Industrial application of lasers.
- To provide adequate knowledge about 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.

TEXT BOOKS

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India, 1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.

REFERENCES

1. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3. John F. Read, 'Industrial Applications of Lasers', Academic Press, 1978.
4. Monte Ross, 'Laser Applications', McGraw Hill, 1968

612EET08 - VISUAL LANGUAGES AND APPLICATIONS

AIM

To study the principles and techniques of windows programming using MFC, procedures, resources, controls and database programming through the visual languages, Visual C++ and Visual Basic.

OBJECTIVES

i. To study about the concepts of windows programming models, MFC applications, drawing with the GDI, getting inputs from Mouse and the Keyboard.
ii. To study the concepts of Menu basics, menu magic and classic controls of the windows programming using VC++.
iii. To study the concept of Document/View Architecture with single & multiple document interface, toolbars, status bars and File I/O Serialization.
iv. To study about the integrated development programming event driven programming, variables, constants, procedures and basic ActiveX controls in visual basic.
v. 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. Model dialog boxes – Modeless dialog boxes.

UNIT III DOCUMENT / VIEW ARCHITECTURE

The inexistence 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 – File controls.

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 list control – 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.

TEXT BOOKS

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

REFENENCES

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.

612EET09 - ADVANCED CONTROL SYSTEM

AIM

To gain knowledge in state variable analysis, non-linear systems and optimal control.

OBJECTIVES

- To study the state variable analysis
- To provide adequate knowledge in the phase plane analysis.
- To give a basic knowledge in describing function analysis.
- To analyze the stability of the systems using different techniques.
- To study the design of optimal controller.

UNIT I STATE VARIABLE ANALYSIS

Concept of state – State Variable and State Model – State models for linear and continuous time systems – Solution of state and output equation – controllability and observability - Pole Placement – State observer Design of Control Systems with observers.

UNIT II PHASE PLANE ANALYSIS

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearising non-linear systems - 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 – Conditions for stability – Stability of oscillations.

UNIT IV STABILITY ANALYSIS

Introduction – Liapunov's stability concept – Liapunov's direct method – Lure's transformation – Aizerman's and Kalman's conjecture – Popov's criterion – Circle criterion.

UNIT V OPTIMAL CONTROL

Introduction -Decoupling - Time varying optimal control – LQR steady state optimal control – Optimal estimation – Multivariable control design.

TEXT BOOKS

1. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.
2. Ashish Tewari, 'Modern control Design with Matlab and Simulink', John Wiley, New Delhi, 2002.

REFERENCES

1. George J. Thaler, 'Automatic Control Systems', Jaico Publishers, 1993.
2. M.Gopal, Modern control system theory, New Age International Publishers, 2002.
3. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, " Feedback Control of Dynamic Systems", Fourth edition, Pearson Education, Low price edition. 2002.

612EET10 - ROBOTICS AND AUTOMATION

AIM

To provide comprehensive knowledge of robotics in the design, analysis and control point of view.

OBJECTIVES

- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the Euler, Lagrangian formulation of Robot dynamics.
- To study the trajectory planning for robot.
- To study the control of robots for some specific applications.

UNIT I BASIC CONCEPTS

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov's laws of robotics – dynamic stabilization of robots.

UNIT II POWER SOURCES AND SENSORS

Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

UNIT III MANIPULATORS, ACTUATORS AND GRIPPERS

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

UNIT IV KINEMATICS AND PATH PLANNING

Solution of inverse kinematics problem – multiple solution jacobian work envelop – hill climbing techniques – robot programming languages.

UNIT V CASE STUDIES

Mutiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

TEXT BOOKS

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

REFERENCES

1. Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 1992.
2. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.
3. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.
4. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA, 1991.
5. Issac Asimov I Robot, Ballantine Books, New York, 1986.

612EET11 - PROFESSIONAL ETHICS IN ENGINEERING

UNIT I 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 – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and
Bhopal.

UNIT IV RESPONSIBILITIES AND RIGHTS

Collegiality and Loyalty – 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 – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, (2000).

REFERENCES

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003)

612EET12 - POWER SYSTEM TRANSIENTS

AIM

To review the over voltages (or) surges due to the phenomena of switching operations and lighting discharge. Also to study propagation, reflection and refraction of these surges on the equipments their impact on the power system grid.

OBJECTIVES

- To study the generation of switching transients and their control using circuit – theoretical concept.
- To study the mechanism of lighting strokes and the production of lighting 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 restrike, 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.

TEXT BOOKS

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Interscience, New York, 2nd edition 1991.
2. R.D.Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.

REFERENCES

1. M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, 2nd edition, 2000.

612EEP01 - MICROPROCESSOR AND MICRO CONTROLLER LABORATORY

AIM

- To understand programming using instruction sets of processors.
- To study various digital & linear

8-bit Microprocessor

1. Simple arithmetic operations: Multi precision addition / subtraction / multiplication / division.
2. Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers,Rotate instructions Hex / ASCII / BCD code conversions.
3. A/D Interfacing.
4. D/A Interfacing.
5. Traffic light controller Interfacing
6. Steeper Motor Interfacing
7. Simple experiments using 8251, 8279, 8254.

16-bit Microprocessor

8. Simple arithmetic operations: Multi Precision addition / substraction/ multiplication / division.

8-bit Microcontroller

9. Demonstration of basic instructions with 8051 Micro controller execution, including:
    a. Conditional jumps, looping
    b. Calling subroutines.
    c. Stack parameter testing

10. Interfacing Keyboard and Display
11. Steepter motor Interfacing\
    a. D/A Interfacing
    b. Traffic light controller Interfacing
    c. 8051 based Serial Port Communication.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	IC Number / Code	Quantity required
1.	8085 Microprocessor Trainer with Power supply	-	15
2.	8051 Micro controller Trainer Kit with power supply	-	15
3.	8086 Microprocessor Trainer Kit	-	10
4.	8255 Interface board	-	5
5.	8251 Interface board	-	5
6.	8259 Interface board	-	5
7.	8279 Keyboard/Display Interface Board	-	5
8.	8254 timer counter	-	5
9.	ADC and DAC card	-	5
10.	Stepper motor with Controller	-	5
11.	Traffic Light Control System	-	5
12.	Regulated power supply	-	10
13.	Universal ADD-ON modules	-	5
14.	8 Digit Multiplexed Display Card	-	5
15.	Multimeter	-	5
16.	C R O	-	2

612EEP02 - PRESENTATION SKILLS AND TECHNICAL SEMINAR

OBJECTIVE

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. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

SEVENTH SEMESTER

712EET01 - POWER SYSTEM OPERATION AND CONTROL

AIM: To understand the day to day operation of power system and the control actions to be implemented on the system to meet the minute-to-minute variation of system load demand.

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.

UNIT I INTRODUCTION

System load – variation - load characteristics - load curves and load-duration curve (daily, weekly and annual) - load factor - diversity factor. Importance of load forecasting and simple techniques of forecasting. An overview of power system operation and control and the role of computers in the implementation. (Qualitative treatment with block diagram).

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. Integration of economic dispatch control with LFC. Two-area system – modeling - static analysis of uncontrolled case - tie line with frequency bias control of two-area system - state variable model.

UNIT III REACTIVE POWER–VOLTAGE CONTROL

Basics of reactive power control. Excitation systems – modeling. Static and dynamic analysis - stability compensation - generation and absorption of reactive power. Relation between voltage, power and reactive power at a node - method of voltage control – tapchanging transformer. System level control using generator voltage magnitude setting, tap setting of OLTC transformer and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.

UNIT IV COMMITMENT AND ECONOMIC DISPATCH

Statement of economic dispatch problem – cost of generation – incremental cost curve - co-ordination equations without loss and with loss, solution by direct method and λ- iteration method. (No derivation of loss coefficients). Statement of Unit Commitment problem – constraints; spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints. Solution methods - Priority-list methods - forward dynamic programming approach. Numerical problems only in priority-list method using full-load average production cost.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS

Need of computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology – state estimation - security analysis and control. Various operating states (Normal, alert, emergency, in-extremis and restorative). State transition diagram showing various state transitions and control strategies.

TEXT BOOKS

1. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
2. Chakrabarti & Halder, "Power System Analysis: Operation and Control", Prentice Hall of India, 2004 Edition.

REFERENCES

1. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003. (For Chapters 1, 2 & 3)
2. L.L. Grigsby, 'The Electric Power Engineering, Hand Book', CRC Press & IEEE Press, 2001.
3. Hadi Saadat, "Power System Analysis", (For the chapters 1, 2, 3 and 4)11th Reprint 2007.
4. P.Kundur, 'Power System Stability and Control' MC Craw Hill Publisher, USA, 1994.
5. Olle.I.Elgerd, 'Electric Energy Systems theory An introduction' Tata McGraw Hill Publishing Company Ltd. New Delhi, Second Edition 2003.

712EET02 - PROTECTION AND SWITCHGEAR

AIM: To introduce the students to the various abnormal operating conditions in power system and describe the apparatus and system protection schemes. Also to describe the phenomena of current interruption to study the various switchgears.

OBJECTIVES:

- To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- To understand the characteristics and functions of relays and protection schemes.
- To understand the problems associated with circuit interruption by a circuit breaker.

UNIT I INTRODUCTION

Importance of protective schemes for electrical apparatus and power system. Qualitative review of faults and fault currents - relay terminology – definitions - and essential qualities of protection. Protection against over voltages due to lightning and switching - arcing grounds - Peterson Coil - ground wires - surge absorber and diverters Power System earthing – neutral Earthing - basic ideas of insulation coordination.

UNIT II OPERATING PRINCIPLES AND RELAY CHARACTERISTICS

Electromagnetic relays – over current, directional and non-directional, distance, negative sequence, differential and under frequency relays – Introduction to static relays.

UNIT III APPARATUS PROTECTION

Main considerations in apparatus protection - transformer, generator and motor protection - protection of busbars. Transmission line protection - zones of protection. CTs and PTs and their applications in protection schemes.

UNIT IV THEORY OF CIRCUIT INTERRUPTION

Physics of arc phenomena and arc interruption. DC and AC circuit breaking – restriking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current.

UNIT V CIRCUIT BREAKERS

Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers – comparative merits of different circuit breakers – testing of circuit breakers.

TEXT BOOKS:

1. M.L. Soni, P.V. Gupta, V.S. Bhatnagar, A. Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co., 1998. (For All Chapters 1, 2, 3, 4 and 5).
2. R.K.Rajput, A Tex book of Power System Engineering. Laxmi Publications, First Edition Reprint 2007.

REFERENCES

1. Sunil S. Rao, 'Switchgear and Protection', Khanna publishers, New Delhi, 1986.
2. C.L. Wadhwa, 'Electrical Power Systems', Newage International (P) Ltd., 2000.
3. B. Ravindranath, and N. Chander, 'Power System Protection & Switchgear', Wiley Eastern Ltd., 1977.
4. Badri Ram, Vishwakarma, 'Power System Protection and Switchgear', Tata Hill, 2001.
5. Y.G. Paithankar and S.R. Bhide, 'Fundamentals of Power System Protection', Prentice Hall of India Pvt. Ltd., New Delhi–110001, 2003.

712EET03 - SPECIAL ELECTRICAL MACHINES

AIM

To expose the students to the construction, principle of operation and performance of special electrical machines as an extension to the study of basic electrical machines.

OBJECTIVES

- To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors.
- Construction, principle of operation, control and performance of stepping motors.
- Construction, principle of operation, control and performance of switched reluctance motors.
- Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- 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 and Hybrid Motors – SYNREL Motors – Voltage and Torque Equations - Phasor diagram - Characteristics.

UNIT II STEPPING MOTORS

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Torque equations – Modes of excitations – Characteristics – Drive circuits – Microprocessor control of stepping motors – Closed loop control.

UNIT III SWITCHED RELUCTANCE MOTORS

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

UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS

Permanent Magnet materials – Magnetic Characteristics – Permeance coefficient - Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Commutation - Power controllers – Motor characteristics and control.

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS

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

TEXT BOOKS

1. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
2. 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.

712EET04 - PRINCIPLES OF MANAGEMENT

UNIT I OVERVIEW OF MANAGEMENT

Definition - Management - Role of managers - Evolution of Management thought - Organization and the environmental factors – Trends and Challenges of Management in Global Scenario.

UNIT II PLANNING

Nature and purpose of planning - Planning process - Types of plans – Objectives -Managing by objective (MBO) Strategies - Types of strategies - Policies – Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions.

UNIT III ORGANIZING

Nature and purpose of organizing - Organization structure - Formal and informal groups *I* organization - Line and Staff authority - Departmentation - Span of control -
Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages – Training - Performance Appraisal.

UNIT IV DIRECTING

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership Styles - Leadership theories - Communication - Barriers to effective communication - Organization Culture - Elements and types of culture – Managing cultural diversity.

UNIT V CONTROLLING

Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control – Maintenance Control - Quality Control - Planning operations.

TEXT BOOKS:

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

REFERENCES:

1. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global & Entrepreneurial Perspective', Tata Mcgraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, 'Essentials of Management', Thomson Southwestern, 7th edition, 2007.

712EET05 - OPERATING SYSTEMS

AIM: To learn the various aspects of operating systems such as process management, memory management, file systems, and I/O management.

UNIT I PROCESSES AND THREADS

Introduction to operating systems – review of computer organization – operating system structures – system calls – system programs – system structure – virtual machines. Processes: Process concept – Process scheduling – Operations on processes – Cooperating processes – Interprocess communication – Communication in client-server systems. Case study: IPC in Linux. Threads: Multi-threading models – Threading issues. Case Study: Threads library.

UNIT II PROCESS SCHEDULING AND SYNCHRONIZATION

CPU Scheduling: Scheduling criteria – Scheduling algorithms – Multiple-processor scheduling – Real time scheduling – Algorithm Evaluation. Case study: Process scheduling in Linux. Process Synchronization: The critical-section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – critical regions – Monitors. Deadlock: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock.

UNIT III STORAGE MANAGEMENT

Memory Management: Background – Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging. Virtual Memory:Background – Demand paging – Process creation – Page replacement –Allocation of frames – Thrashing. Case Study: Memory management in Linux

UNIT IV FILE SYSTEMS

File-System Interface: File concept – Access methods – Directory structure –Filesystem mounting – Protection. File-System Implementation: Directory implementation – Allocation methods – Free-space management – efficiency and performance – recovery – log-structured file systems. Case studies: File system in Linux – file system in Windows XP.

UNIT V I/O SYSTEMS

I/O Systems – I/O Hardware – Application I/O interface – kernel I/O subsystem – streams – performance. Mass-Storage Structure: Disk scheduling – Disk management – Swap-space management – RAID – disk attachment – stable storage – tertiary storage. Case study: I/O in Linux.

TEXT BOOKS

1. Silberschatz, Galvin, and Gagne, "Operating System Concepts", Sixth Edition, Wiley India Pvt Ltd, 2003.
2. D. M. Dhamdhere, "Operating Systems: A concepts based approach", Second Edition, Tata McGraw-Hill Publishing Company Ltd., 2006.

REFERENCES

1. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education/PHI, 2001.
2. Harvey M. Deital, "Operating Systems", Third Edition, Pearson Education, 2004.

ELECTIVE II
712EET06 - BIO–MEDICAL INSTRUMENTATION

AIM

The course is designed to make the student acquire an adequate knowledge of the physiological systems of the human body and relate them to the parameters that have clinical importance. The fundamental principles of equipment that are actually in use at the present day are introduced.

OBJECTIVES

- To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Biomedical applications of different transducers used.
- To introduce the student to the various sensing and measurement devices of electrical origin. To provide awareness of electrical safety of medical equipments
- To provide the latest ideas on devices of non-electrical devices.
- To bring out the important and modern methods of imaging techniques.
- To provide latest knowledge of medical assistance / techniques and therapeutic equipments.

UNIT I PHYSIOLOGY AND TRANSDUCERS

Cell and its structure – Resting and Action Potential – Nervous system: Functional organisation of the nervous system – Structure of nervous system, neurons - synapse – transmitters and neural communication – Cardiovascular system – respiratory system – Basic components of a biomedical system - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

UNIT II ELECTRO – PHYSIOLOGICAL MEASUREMENTS

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 III NON-ELECTRICAL PARAMETER MEASUREMENTS

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 IV MEDICAL IMAGING

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Introduction to Biometric systems.

UNIT V ASSISTING AND THERAPEUTIC EQUIPMENTS

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy.

TEXT BOOKS

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.

REFERENCES

1. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
2. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
4. C.Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', Universities press (India) Ltd, Orient Longman ltd, 2000.

712EET07 - INTELLIGENT CONTROL

UNIT I INTRODUCTION

Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. Expert systems.

UNIT II ARTIFICIAL NEURAL NETWORKS

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations. Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller.

UNIT III GENETIC ALGORITHM

Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tabu search and ant-colony search techniques for solving optimization problems.

UNIT IV FUZZY LOGIC SYSTEM

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Fuzzy logic control for nonlinear time-delay system.

UNIT V APPLICATIONS

GA application to power system optimisation problem, Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analysis of Neural-Network interconnection systems. Implementation of fuzzy logic controller using Matlab fuzzy-logic toolbox. Stability analysis of fuzzy control systems.

TEXT BOOKS

1. Padhy.N.P.(2005), Artificial Intelligence and Intelligent System, Oxford University Press.
2. KOSKO,B. "Neural Networks And Fuzzy Systems", Prentice-Hall of India Pvt. Ltd., 1994.

REFERENCES

1. Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1999.
2. KLIR G.J. & FOLGER T.A. "Fuzzy sets, uncertainty and Information", Prentice-Hall of India Pvt. Ltd., 1993.
3. Zimmerman H.J. "Fuzzy set theory-and its Applications"-Kluwer Academic Publishers, 1994.
4. Driankov, Hellendroon, "Introduction to Fuzzy Control", Narosa Publishers.
5. Goldberg D.E. (1989) Genetic algorithms in Search, Optimization and Machine learning, Addison Wesley.

712EET08 - POWER SYSTEM DYNAMICS

AIM

To understand the concept of modelling the power system and the components for simulating the transient and dynamic behaviour of power system meant for the stability studies.

OBJECTIVES

- To review the modeling of synchronous machine, the excitation system and speedgoverning controllers.
- To study small signal stability analysis of a single-machine infinite bus system with excitation system and power system stabilizer.
- To study transient stability simulation of multimachine 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 distinctionbetween 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 multimachine system with one axis model and simulation – modeling of multimachine 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.

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.

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.

712EET09 - COMPUTER ARCHITECTURE

UNIT I INSTRUCTION SET ARCHITECTURE

Introduction to computer architecture - Review of digital design – Instructions and addressing – procedures and data – assembly language programs – instruction set variations.

UNIT II ARITHMETIC/LOGIC UNIT

Number representation – design of adders – design of simple ALUs – design of Multipliers and dividers – design of floating point arithmetic unit

UNIT III DATA PATH AND CONTROL

Instruction execution steps – control unit synthesis – microprogramming – pipelining – pipeline performance.

UNIT IV MEMORY SYSTEM

Main Memory concepts – types of memory – cache memory organization – secondary storage – virtual memory – paging.

UNIT V I/O AND INTERFACES

I/O devices – I/O programming – polling – interrupts – DMA – buses – links – interfacing – context switching – threads and multithreading.

TEXT BOOKS:

1. B. Parhami, "Computer Architecture", Oxford University Press, 2005.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2002.

REFERENCES:

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Third Edition, Elsevier, 2004.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Seventh Edition, Pearson Education, 2006.
3. Miles Murdocca "Computers Architecture and Organization An Integrated approach", Wiley India pvt Ltd, 2007
4. John D. Carpinelli, "Computer systems organization and Architecture", Pearson Education, 2001.

712EET10 - TOTAL QUALITY MANAGEMENT

UNIT I INTRODUCTION

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & 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 & TECHNIQUES II

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TEXT BOOK

1. Dale H.Besterfiled, et at., "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", (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition (2003).
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd. (2006)
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd. (2006)

712EEP01 - POWER SYSTEM SIMULATION LABORATORY

AIM

To acquire software development skills and experience in the usage of standard packages necessary for analysis and simulation of power system required for its planning, operation and control.

OBJECTIVES

i. To develop simple C programs for the following basic requirements:
   a) Formation of bus admittance and impedance matrices and network solution.
   b) Power flow solution of small systems using simple method, Gauss-Seidel P.F. method.
   c) Unit Commitment and Economic Dispatch.

ii. To acquire experience in the usage of standard packages for the following analysis / simulation / control functions.
   a) Steady-state analysis of large system using NRPF and FDPF methods.
   b) Quasi steady-state (Fault) analysis for balanced and unbalanced faults.
   c) Transient stability simulation of multimachine power system.
   d) Simulation of Load-Frequency Dynamics and control of power system.

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 and Fast-Decoupled Methods
5. Fault Analysis
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.
7. Transient Stability Analysis of Multimachine 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.

Detailed Syllabus

1. COMPUTATION OF PARAMETERS AND MODELLING OF TRANSMISSION LINES

Aim

(i) To determine the positive sequence line parameters L and C per phase per kilometer of a three phase single and double circuit transmission lines for different conductor arrangements.

(ii) To understand modelling and performance of short, medium and long lines.

Exercises

1.1 Computation of series inductance and shunt capacitance per phase per km of a three phase line with flat horizontal spacing for single stranded and bundle conductor configuration.

1.2 Computation of series inductance and shunt capacitance per phase per km of a three phase double circuit transmission line with vertical conductor arrangement with bundle conductor.

1.3 Computation of voltage, current, power factor, regulation and efficiency at the receiving end of a three phase Transmission line when the voltage and power at the sending end are given. Use Π model.

1.4 Computation of receiving end voltage of a long transmission for a given sending end voltage and when the line is open circuited at receiving. Also compute the shunt reactor compensation to limit the no load receiving end voltage to specified value.

1.5 Determination of the voltage profile along the long transmission line for the following cases of loading at receiving end (i) no load (ii) rated load (iii) surge impedance loading and (iv) receiving end short circuited.

2. FORMATION OF BUS ADMITTANCE AND IMPEDANCE MATRICES AND SOLUTION OF NETWORKS

Aim

To understand the formation of network matrices, the bus admittance matrix **Y** and the bus impedance matrix **Z** of a power network, to effect certain required changes on these matrices and to obtain network solution using these matrices.

Exercises

2.1 Write a program in C language for formation of bus admittance matrix **Y** of a power network using the "Two-Rule Method", given the data pertaining to the transmission lines, transformers and shunt elements. Run the program for a sample 6 bus system and compare the results with that obtained using a standard software.

2.2 Modify the program developed in 2.1 for the following:

(i) To obtain modified **Y** matrix for the outage of a transmission line, a Transformer and a shunt element.

(ii) To obtain network solution **V** given the current injection vector **I**

(iii) To obtain full **Z** matrix or certain specified columns of **Z** matrix. Verify the correctness of the modified program using 6 bus sample system

2.3 Write a program in C language for forming bus impedance matrix **Z** using the "Building Algorithm".

* Optional (not mandatory)

EXPERIMENT 3
LOAD FLOW ANALYSIS - I : SOLUTION OF LOAD FLOW AND RELATED PROBLEMS USING GAUSS-SEIDEL METHOD

Aim

(i) To understand, the basic aspects of steady state analysis of power systems that are required for effective planning and operation of power systems.

(ii) To understand, in particular, the mathematical formulation of load flow model in complex form and a simple method of solving load flow problems of small sized system using Gauss-Seidel iterative algorithm

Exercises

3.1 Write a program in c language for iteratively solving load flow equations using Gauss-Seidel method with provision for acceleration factor and for dealing with P-V buses. Run the program for a sample 6 bus system (Base case) and compare the results with that obtained using a standard software.

3.2 Solve the "Base case" in 3.1 for different values of acceleration factor, draw the convergence characteristics "Iteration taken for convergence versus acceleration factor" and determine the best acceleration factor for the system under study.

3.3 Solve the "Base Case" in 3.1 for the following changed conditions and comment on the results obtained, namely voltage magnitude of the load buses and transmission losses:

(i) Dropping all shunt capacitors connected to network

(ii) Changing the voltage setting of generators Vgi over the range 1.00 to 1.05

(iii) Changing the tap setting of the transformers, ai, over the range 0.85 to 1.1

3.4 Resolve the base case in 3.1 after shifting generation from one generator bus to another generator bus and comment on the MW loading of lines and transformers.

4. LOAD FLOW ANALYSIS – I: SOLUTION OF LOAD FLOW AND RELATED PROBLEMS USING NEWTON-RAPHSON AND FAST DECOUPLED METHODS

Aim

(i) To understand the following for medium and large scale power systems:
(a) Mathematical formulation of the load flow problem in real variable form
(b) Newton-Raphson method of load flow (NRLF) solution
(c) Fast Decoupled method of load flow (FDLF) solution
(ii) To become proficient in the usage of software for practical problem solving in the areas of power system planning and operation.
(iii) To become proficient in the usage of the software in solving problems using Newton-Raphson and Fast Decoupled load flow methods.

Exercises

4.1 Solve the load flow problem (Base case) of a sample 6 bus system using Gauss-Seidel, Fast Decoupled and Newton-Raphson Load Flow programs for a mismatch convergence tolerance of 0.01 MW, plot the convergence characteristics and compare the convergence rate of the three methods.

4.2 Obtain an optimal (minimum transmission loss) load flow solution for the Base case loading of 6 bus sample system by trial and error approach through repeated load flow solutions using Fast Decoupled Load Flow package for different combinations of generator voltage settings, transformer tap settings, and reactive power of shunt elements.

4.3 Carry out contingency analysis on the optimal state obtained in 4.2 for outage of a transmission line using FDLF or NRLF package.

4.4 Obtain load flow solutions using FDLF or NRLF package on the optimal state obtained in 4.2 but with reduced power factor (increased Q load) load and comment on the system voltage profile and transmission loss.

4.5 Determine the maximum loadability of a 2 bus system using analytical solution as well as numerical solution using FDLF package. Draw the P-V curve of the system.

4.6 For the base case operating state of the 6 bus system in 4.1 draw the P-V curve for the weakest load bus. Also obtain the voltage Stability Margin (MW Index) at different operating states of the system.

4.7 For the optimal operating state of 6 bus system obtained in 4.2 determine the Available Transfer Capability (ATC) between a given "source bus" and a given "s

5. FAULT ANALYSIS

Aim

To become familiar with modelling and analysis of power systems under faulted condition and to compute the fault level, post-fault voltages and currents for different types of faults, both symmetric and unsymmetric.

Exercises

5.1 Calculate the fault current, post fault voltage and fault current through the branches for a three phase to ground fault in a small power system and also study the effect of neighbouring system. Check the results using available software.

5.2 Obtain the fault current, fault MVA, Post-fault bus voltages and fault current

distribution for single line to ground fault, line-to-line fault and double line to ground fault for a small power system, using the available software. Also check the fault current and fault MVA by hand calculation.

5.3 Carryout fault analysis for a sample power system for LLLG, LG, LL and LLG faults and prepare the report.

6. TRANSIENT AND SMALL-SIGNAL STABILITY ANALYSIS: SINGLE MACHINE-INFINITE BUS SYSTEM

Aim

To become familiar with various aspects of the transient and small signal stability analysis of Single-Machine Infinite Bus (SMIB) system.

Exercises

For a typical power system comprising a generating, step-up transformer, double-circuit transmission line connected to infinite bus:

Transient Stability Analysis

6.1 Hand calculation of the initial conditions necessary for the classical model of the synchronous machine.

6.2 Hand computation of critical clearing angle and time for the fault using equal area criterion.

6.3 Simulation of typical disturbance sequence: fault application, fault clearance by opening of one circuit using the software available and checking stability by plotting the swing curve.

6.4 Determination of critical clearing angle and time for the above fault sequence through trial and error method using the software and checking with the hand computed value.

6.5 Repetition of the above for different fault locations and assessing the fault severity with respect to the location of fault

6.6 Determination of the steady-state and transient stability margins.

Small-signal Stability Analysis:

6.7 Familiarity with linearised swing equation and characteristic equation and its roots, damped frequency of oscillation in Hz, damping ratio and undamped natural frequency.

6.8 Force-free time response for an initial condition using the available software.

6.9 Effect of positive, negative and zero damping.

7. TRANSIENT STABILITY ANALYSIS OF MULTIMACHINE POWER SYSTEMS

Aim

To become familiar with modelling aspects of synchronous machines and network, stateof- the-art algorithm for simplified transient stability simulation, system behaviour when subjected to large disturbances in the presence of synchronous machine controllers and to become proficient in the usage of the software to tackle real life problems encountered in the areas of power system planning and operation.

Exercises

For typical multi-machine power system:

7.1 Simulation of typical disturbance sequence: fault application, fault clearance by opening of a line using the software available and assessing stability with and without controllers.

7.2 Determination of critical clearing angle and time for the above fault sequence through trial and error method using the software.

7.3 Determination of transient stability margins.

7.4 Simulation of full load rejection with and without governor.

7.5 Simulation of loss of generation with and without governor.
7.6 Simulation of loss of excitation (optional).
7.7 Simulation of under frequency load shedding scheme (optional).

8. ELECTROMAGNETIC TRANSIENTS IN POWER SYSTEMS

Aim

To study and understand the electromagnetic transient phenomena in power systems caused due to switching and faults by using Electromagnetic Transients Program (EMTP) and to become proficient in the usage of EMTP to address problems in the areas of over voltage protection and mitigation and insulation coordination of EHV systems.

Exercises

Using the EMTP software or equivalent Simulation of single-phase energisation of the load through single-phase pi-model of a transmission line and understanding the effect of source inductance.

8.1 Simulation of three-phase energisation of the load through three-phase pi-model of a transmission line and understanding the effect of pole discrepancy of a circuit breaker.
8.2 Simulation of energisation of an open-ended single-phase distributed parameter transmission line and understanding the travelling wave effects.
8.3 Simulation of a three-phase load energisation through a three-phase distributed parameter line with simultaneous and asynchronous closing of circuit breaker and studying the effects.
8.4 Study of transients due to single line-to-ground fault.
8.5 Computation of transient recovery voltage.

9. LOAD-FREQUENCY DYNAMICS OF SINGLE-AREA AND TWOAREA POWER SYSTEMS

Aim

To become familiar with the modelling and analysis of load-frequency and tie-line flow dynamics of a power system with load-frequency controller (LFC) under different control modes and to design improved controllers to obtain the best system response.

Exercises

9.1 Given the data for a Single-Area power system, simulate the load-frequency dynamics (only governor control) of this area for a step load disturbance of small magnitude, plot the time response of frequency deviation and the corresponding change in turbine power. Check the value of steady state frequency deviation obtained from simulation with that obtained by hand calculation.
9.2 Carry out the simulation of load-frequency dynamics of the Single-Area power system in 9.1 with Load-frequency controller (Integral controller) for different values of KI (gain of the controller) and choose the best value of KI to give an "optimal" response with regard to peak over shoot, settling time, steady-state error and Mean- Sum-Squared-Error.
9.3 Given the data for a two-area (identical areas) power system, simulate the loadfrequency dynamics (only governor control) of this system for a step load disturbance in one area and plot time response of frequency deviation, turbine power deviation and tie-line power deviation. Compare the steady-state frequency deviation obtained with that obtained in the case of single-area system.
9.4 Carry out the simulation of load-frequency dynamics of two-area system in 9.3 for the following control modes:
    (i) Flat tie-line control
    (ii) Flat frequency control
    (iii) Frequency bias tie-line control and for the frequency bias Tie-line control mode, determine the optimal values of gain and frequency bias factor required to get the "best" time response.

9.5 Given the data for a two-area (unequal areas) power system, determine the best controller parameters; gains and bias factors to give an optimal response for frequency deviation and tie-line deviations with regard to peak overshoot, settling time, steady-state error and Mean-Sum-Squared-Error.

10. ECONOMIC DISPATCH IN POWER SYSTEMS

Aim

(i) To understand the basics of the problem of Economic Dispatch (ED) of optimally adjusting the generation schedules of thermal generating units to meet the system load which are required for unit commitment and economic operation of power systems.

(ii) To understand the development of coordination equations (the mathematical model for ED) without and with losses and operating constraints and solution of these equations using direct and iterative methods

Exercises

10.1. Write a program in 'C' language to solve economic dispatch problem of a power system with only thermal units. Take production cost function as quadratic and neglect transmission loss.

10.2. Write a program in 'C' language to solve economic dispatch problem of a power system. Take production cost as quadratic and include transmission loss using loss co-efficient. Use λ-iteration algorithm for solving the coordination equations.

10.3. Determine using the program developed in exercise 10.1 the economic generation schedule of each unit and incremental cost of received power for a sample power system, for a given load cycle.

10.4. Determine using the program developed in exercise 10.2 the economic generation schedule of each unit, incremental cost of received power and transmission loss for a sample system, for the given load levels.

10.5. Apply the software module developed in 10.1 to obtain an optimum unit commitment schedule for a few load levels.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity required
1.	Personal computers (Pentium-IV, 80GB, 512 MBRAM)	25
2.	Printer laser	1
3.	Dotmatrix	1
4.	Server (Pentium IV, 80GB, 1GBRAM) (High Speed Processor)	1
5.	Software: E.M.T.P/ETAP/CYME/MIPOWER /any power system simulation software	5 licenses
6.	Compliers: C, C++, VB, VC++	25 users

EIGHTH SEMESTER

812EET01 - ELECTRIC ENERGY GENERATION AND UTILISATION AND CONSERVATION

AIM

To expose students to the main aspects of generation, utilization and conservation.

OBJECTIVES

- To impart knowledge on Generation of electrical power by conventional and non–conventional methods.
- Electrical energy conservation, energy auditing and power quality.
- Principle and design of illumination systems and methods of heating and welding.
- Electric traction systems and their performance.
- Industrial applications of electric drives.

UNIT I POWER GENERATION

Review of conventional methods – thermal, hydro and nuclear based power generation. Non-conventional methods of power generation – fuel cells - tidal waves – wind – geothermal – solar - bio-mass - municipal waste. Cogeneration. Effect of distributed generation on power system operation.

UNIT II ECONOMIC ASPECTS OF GENERATION

Economic aspects of power generation – load and load duration curves – number and size of units – cost of electrical energy – tariff. Economics of power factor improvement – power capacitors – power quality. Importance of electrical energy conservation – methods – energy efficient equipments. Introduction to energy auditing.

UNIT III ILLUMINATION

Importance of lighting – properties of good lighting scheme – laws of illumination – photometry - types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, and sports ground – energy efficiency lamps.

UNIT IV INDUSTRIAL HEATING AND WELDING

Role electric heating for industrial applications – resistance heating – induction heating – dielectric heating - electric arc furnaces. Brief introduction to electric welding – welding generator, welding transformer and the characteristics.

UNIT V ELECTRIC TRACTION

Merits of electric traction – requirements of electric traction system – supply systems – mechanics of train movement – traction motors and control – braking – recent trends in electric traction.

TEXT BOOKS

1. C.L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', New Age International Pvt. Ltd, 2003.
2. B.R. Gupta, 'Generation of Electrical Energy', Eurasia Publishing House (P) Ltd, New Delhi, 2003.

REFERENCES

1. H. Partab, 'Art and Science of Utilisation of Electrical Energy', Dhanpat Rai and Co, New Delhi, 2004.
2. E. Openshaw Taylor, 'Utilization of Electrical Energy in SI Units', Orient Longman Pvt. Ltd, 2003.
3. J.B. Gupta, 'Utilization of Electric Power and Electric Traction', S.K.Kataria and Sons, 2002.

ELECTIVE III & IV
812EET02 - POWER QUALITY

AIM:
To study the various issues affecting power quality, their production, monitoring and suppression.

OBJECTIVES:
- To study the production of voltages sags, overvoltages and harmonics and methods of control.
- To study 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.

TEXT BOOKS

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill,2003.(For Chapters1,2,3, 4 and 5)

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. J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', (New York: Wiley, 1999). (For Chapters 1, 2, 3, 4 and 5)
4. PSCAD User Manual.

812EET03 - SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL

UNIT I PARAMETRIC METHODS

Nonparametric methods: Transient analysis-frequency analysis-Correlation analysis- Spectral analysis.

UNIT II PARAMETRIC METHODS

Linar Regression: The Lease square esimate-best liner unbiased etimation under linear constraints- updating the Parameter estimates for linear regression models- Predcion error methods: Description of Prediction error methods-Optimal Predictio – relationships between Prediction error methods and other identification methodstheoretical analysis. Instrumental variable methods: description of nstrumental variable methods-theoretical analysis-covariance matrix of IV estimates- Comparison of optimal IV predicion error methods.

UNIT III RECURSIVE IDENTIFICATION METHODS

The recursive lest squares method-the recursive Instrumentl varible method-the recursive prediction error method-model validatio and model structure etermination. Indenification of systems operating in closed loop: Identifiability considerations-direct indentification-Indirect indentification-joint input – output identification.

UNIT IV ADAPTIVE CONTROL SCHEMES

Introduction – users- Definitions-auto tuning-types of adaptive control-gain scheduling controller-model reference adaptive control schemes – self tunning controller. MRAC and STC : Approaches – The Gradient approach – Lyapunov functions – Passivity theory – pole placement method Minimum variance control – Predictive control.

UNIT V ISSUES IN ADAPIVE CONTROL AND APPLICATION

Stability – Convergence – Robustness – Application of adaptive control.

TEXT BOOKS

1. Soderstorm.T and Petre stioca, System Identification, Prentice Hall International (UK) Ltd. 1989.
2. Karl J.Astrom and Bjorn Wittenmark, Adaptive Conrol, Pearson Education, 2nd Editon, 2001.

REFERENCES

1. Ljung,L.System Identification: Theory for the user, Pretice Hall, Englewood cliffs, 1987.
2. Sastry S. and Bodson M., daptive control – stability, Convergence ad Robustness, Prentice Hall inc., New Jersey, 12989.

812EET04 - OPERATIONS RESEARCH

AIM:

To introduce the Linear Programming methods, Algorithms, LC PM and PERT.

OBJECTIVES:

- To study various LP methods.
- To study Algorithms methods.
- To study case studies using CPM and PERT

UNIT I INTRODUCTION

Role of Operations Research - Operations Research Models and techniques. LP model and technique – formulation and graphical Solution – graphical sensitivity Analysis. The Simplex Algorithm – the two phase method – degeneracy – alterative optima – unbounded and/or Infeasible Solution – redundancies.

UNIT II PROBLEM FORMULATION

Definitions of the Dual Problem – Primal-dual Relationship – Economic Interpretation of Duality – Dual Simplex Method – Primal Dual Computation – Post Optimal or Sensitivity Analysis – Changes Affecting Feasibility – Changes Affecting Optimality – Revised Simplex Method – LP Packages.

UNIT III ALGORITHMS AND MODELS

Definition of Transportation Model – The Transportation Algorithm – Determination of the Starting Solution – Iterative Computations of an Algorithm – The Assignment Model – The Hungarian Method – The Transshipment Model – Inter Programming Problem – Cutting Plane Algorithm.

UNIT IV NETWORK SOLUTIONS

Scope of Network Applications – Network Solution – Minimal Spanning Tree Algorithm – Shortest Route Problem – Examples – Shortest Route Algorithm – Maximal Flow Model – Minimal cost Capacitated Flow Problems.

UNIT V CASE STUDIES USING CPM AND PERT

Network Diagram Representation – Critical Path Method – Time Estimates – Crashing – Time Charts – PERT and CPM for Project Scheduling – Resource Planning – Case Studies.

TEXT BOOKS

1. Hamdy A. Taha, ”Operation Research – An Introduction“ ,7th Edition Person Education / Prentice Hall of India Edition, Asia, 2002. (For All Chapters 1, 2, 3, 4 and 5)
2. Srinivasn, “Operations Research: Principles and applications”, Prentice Hall of India, 2007 New Edition, (For All Chapters).

REFERENCES

1. Ronald. L. Rardin ,”Optimization in Operation Research”, Pearson Education, Asia, 2002.
2. JIT.S Chandran, Mahendran P.Kawatra Ki Ho Kim ,”Essential of Linear Programming”, Vikas Publishing House Pvt. Ltd., New Delhi, 1994.
3. Hiller F.S, Liberman G.J ,”Introduction to Operation Research”, 7th Edition, McGraw Hill, 2001. (For all Chapters 1, 2, 3, 4 and 5)
4. R.Panneer Selvam ,”Operations Research”, Prentice Hall of India, 2002. (For All Chapters).
5. P.C.Tulsin,”Quantitative Technique : Theory and Problem”, Pearson Education, 2002.
6. Ravindran, Phillips, Solberg ,”Operation Research Principles and Practice”, Second Edition, John Wiley, 1987.

812EET05 - VLSI DESIGN

AIM

Tounderstand th basic concepts of VLSI and CMOS design.

OBJECTIVES

- To give clear idea about the basics of VLSI design and its importance.
- To know about the operating principles of MOS transistor.
- To study about construction of NMOS, CMOS and Bi-CMOS based logic gates.
- To understand the functioning of programmable and Reprogrammable devices.
- To learn about the programming of Programmable device using Hardware description Language.

UNIT I BASIC MOS TRANSISTOR

Enhancement mode & Depletion mode – Fabrication (NMOS, PMOS, CMOS, BiCMOS) Technology – NMOS transistor current equation – second order effects – MOS Transistor Model.

UNIT II NMOS & CMOS INVERTER AND GATES

NMOS & CMOS inverter – Determination of pull up / pull down ratios – stick diagram – lambda based rules – super buffers – BiCMOS & steering logic.

UNIT III SUB SYSTEM DESIGN & LAYOUT

Structured design of combinational circuits – Dynamic CMOS & clocking – Tally circuits – (NAND-NAND, NOR-NOR and AOI logic) – EXOR structure – Multiplexer structures – Barrel shifter.

UNIT IV DESIGN OF COMBINATIONAL ELEMENTS & REGULAR ARRAYLOGIC

NMOS PLA – Programmable Logic Devices - Finite State Machine PLA – Introduction to FPGA, CPLD.

UNIT V VHDL PROGRAMMING

RTL Design – Detructured level Design -combinational logic – Types – Operators – Packages – Sequential circuit – Sub programs – Test benches. (Examples: address, counters, flipflops, FSM, Multiplexers / Demltiplexers).

TEXT BOOKS

1. D.A.Pucknell, K.Eshraghian, 'Basic VLSI Design', 3rd Edition, Prentice Hall of India, New Delhi, 2003.
2. Eugene D.Fabricius, 'Introduction to VLSI Design', Tata McGraw Hill, 1990.

REFERENCES

1. N.H.Weste, 'Principles of CMOS VLSI Design', Pearson Education, India, 2002.
2. Charles H.Roth, 'Fundamentals of Logic Design', Jaico Publishing House, 1992.
3. Zainalatsedin Navabi, 'VHDL Analysis and Modelling of Digital Systems', 2n Edition, Tata McGraw Hill, 1998.
4. Douglas Perry, 'VHDL Programming By Example', Tata McGraw Hill, 3rdEdition.2007.
5. Parag K.Lala, 'Digitl System Design using PLD', BS Publications, 2003.

812EET06 - HIGH VOLTAGE DIRECT CURRENT TRANSMISSION

AIM

To develop the skills in the area of HVDC power transmission with the analysis of HVDC converters, harmonics and design of filters.

OBJECTIVE

- To understand the concept, planning of DC power transmission and comparison with AC power transmission.
- To analyze HVDC converters.
- To study about compounding and regulation.
- To analyze harmonics and design of filters.
- To learn about HVDC cables and simulation tools.

UNIT I INTRODUCTION

Introduction of 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 DC transmission.

UNIT II ANALYSIS OF HVDC CONVERTERS

Pulse number – Choice of converter configuration – Simplified analysis of Graetz circuit – Converter bridge characteristics – Characteristics of a twelve pulse converter – Detailed analysis of converters.

UNIT III COMPOUNDING AND REGULATIONS

General – Required regulation – Inverter compounding – Uncompounded inverter – Rectifier compounding – Transmission characteristics with the rectifier and inverter compounding – Communication link – Current regulation from the inverter side – Transformer tap changing

UNIT IV HARMONICS AND FILTERS

Introduction – Generation of harmonics – Design of AC filters and DC filters – Interference with neighbouring communication lines.

UNIT V HVDC CABLES AND SIMULATION OF HVDC SYSTEMS

Introduction of DC cables – Basic physical phenomenon arising in DC insulation – Practical dielectrics – Dielectric stress consideration – Economics of DC cables compared with AC cables. Introduction to system simulation – Philosophy and tools – HVDC system simulation – Modeling of HVDC systems for digital dynamic simulation.

TEXT BOOK

1. Padiyar, K. R., "HVDC power transmission system", Wiley Eastern Limited, New Delhi 1990. First edition.
2. Edward Wilson Kimbark, "Direct Current Transmission", Vol. I, Wiley interscience, New York, London, Sydney, 1971.

REFERENCES

1. Colin Adamson and Hingorani N G, "High Voltage Direct Current Power Transmission", Garraway Limited, London, 1960.
2. Arrillaga, J., "High Voltage Direct Current Transmission", Peter Pregrinus, London, 1983.
3. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age Interantional (P) Ltd., New Delhi, 1990.

812EET07 - FUNDAMENTAL OF NANOSCIENCE

UNIT I INTRODUCTION

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered 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 PREPARATION METHODS

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

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography.

UNIT IV PREPARATION ENVIRONMENTS

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNIT V CHARECTERISATION 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.

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, Second edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

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

812EET08 - MICRO ELECTRO MECHANICAL SYSTENS

AIM

The aim of this course is to educate the student to understand the fundamentals of Micro Electro Mechanical Systems (MEMS).

OBJECTIVES

- At the end of this course the student will be able to integrate the knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- understand the rudiments of Microfabrication techniques.
- identify and understand the various sensors and actutators
- different materials used for MEMS
- 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 Microfabrication - 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 – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators.

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 – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micromachining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – 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.

TEXT BOOKS.

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2006.
2. James J.Allen, micro electro mechanical system design, CRC Press published in 2005.

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, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.
4. Julian w. Gardner, Vijay k. varadan, Osama O.Awadelkarim,micro sensors mems and smart devices, John Wiley & son LTD,2002

812EET09 - SOFTWARE FOR CIRCUIT SIMULATION

UNIT I INTRODUCTION

Importance of simulation – General purpose circuit analysis – programs – Method of analysis of power electronic systems – Review of modeling of power electronic components and systems.

UNIT II ADVANCED TECHNIQUES IN SIMULATION

Analysis of power electronic systems in a sequential manner coupled and decoupled systems – Various algorithms for computing steady state solution in power electronic systems – Future trends in computer simulation.

UNIT III PSPICE :

Introduction – Pspice overview – DC circuit Analysis –AC circuit analysis – Transient and the time domain – Fourier Series and Harmonic components – An introduction to Pspice devices BJT, FET, MOSFET and is model – Amplifiers and Oscillators – Nor linear Devices.

UNIT IV MATLAB

Introduction - function description – Data types – Tool boxes – Graphical Display: Import and Export of data – Programs for solution of state equations.

UNIT V SIMULINK

Introduction – Graphical user Interface – Selection of objects – Blocks – lines Simulation - Application programs.

TEXT BOOKS

1. Rajagopalan.V 'Computer aided analysis of power electronic systems' Marcell Dekker 1987.

REFERENCES

1. John Keown 'Microsim Pspice and circuit analysis" Prentice hall Inc, 1998.
2. Orcad Pspice User manual, Orcad Corporation, 2006.
3. Matlab / Simulink manual, Maths Work 2007.

812EET10 - COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS

AIM

To introduce the basics of Computer Aided Design technology for the design of Electrical Machines.

OBJECTIVE

- At the end of this course the student will be able to Learn the importance of computer aided design method.
- Understand the basic electromagnetic field equations and the problem formulation for CAD applications.
- Become familiar with Finite Element Method as applicable for Electrical Engineering.
- Know the organization of a typical CAD package.
- Apply 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.

TEXT BOOKS

1. S.J Salon, 'Finite Element Analysis of Electrical Machines', Kluwer Academic Publishers, London, 1995.
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.

812EET11 – FLEXIBLE AC TRANSMISSION SYSTEMS

AIM: To enhance the transmission capability of transmission system by shunt and series compensation using static controllers.

OBJECTIVES:

- To understand the concept of flexible AC transmission and the associated problems.
- To review the static devices for series and shunt control.
- To study the operation of controllers for enhancing the transmission capability.

UNIT I INTRODUCTION

The concept of flexible AC transmission – reactive power control in electrical power transmission lines –uncompensated transmission line – series and shunt compensation. Overview of FACTS devices – Static Var Compensator (SVC) – Thyristor Switched Series capacitor (TCSC) – Unified Power Flow controller (UPFC) – Integrated Power Flow Controller (IPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS

Voltage control by SVC – advantages of slope in dynamic characteristics – influence of SVC on system voltage. Applications – enhancement of transient stability – steady state power transfer – enhancement of power system damping – prevention of voltage instability.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR(TCSC) AND APPLICATIONS

Operation of the TCSC – different modes of operation – modeling of TCSC – variable reactance model – modeling for stability studies. Applications – improvement of the
system stability limit – enhancement of system damping – voltage collapse prevention.

UNIT IV EMERGING FACTS CONTROLLERS

Static Synchronous Compensator (STATCOM) – operating principle – V-I characteristics – Unified Power Flow Controller (UPFC) – Principle of operation – modes of operation – applications – modeling of UPFC for power flow studies.

UNIT V CO-ORDINATION OF FACTS CONTROLLERS

FACTs Controller interactions – SVC–SVC interaction – co-ordination of multiple controllers using linear control techniques – Quantitative treatment of control coordination.

TEXT BOOK:

3. Mohan Mathur, R., Rajiv. K. Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc.

REFERENCES:

4. A.T.John, "Flexible AC Transmission System", Institution of Electrical and Electronic Engineers (IEEE), 1999.
5. Narain G.Hingorani, Laszio. Gyugyl, "Understanding FACTS Concepts and Technology of Flexible AC Transmission System", Standard Publishers, Delhi 2001.

812EET12 - WIND ENERGY CONVERSATION SYSTEMS

1. INTRODUCTION

Components of WECS-WECS schemes-Power obtained from wind-simple momentum theory-Power coefficient-Sabinin's theory-Aerodynamics of Wind turbine.

2. WIND TURBINES

HAWT-VAWT-Power developed-Thrust-Efficiency-Rotor selection-Rotor design considerations-Tip speed ratio-No. of Blades-Blade profile-Power Regulation-yaw control-Pitch angle control-stall control-Schemes for maximum power extraction.

3. FIXED SPEED SYSTEMS

Generating Systems- Constant speed constant frequency systems – Choice of Generators-Deciding factors-Synchronous Generator- Squirrel Cage Induction Generator – Model of Wind Speed – Model wind turbine rotor – Drive Train model-Generator model for Steady state and Transient stability analysis.

4. VARIABLE SPEED SYSTEMS

Need of variable speed systems-Power-wind speed characteristics-Variable speed constant frequency systems synchronous generator – DFIG – PMSG – Variable speed generators modeling – Variable speed variable frequency schemes.

5. GRID CONNECTED SYSTEMS

Stand alone and Grid Connected WECS system – Grid connection Issues – Machine side & Grid side controllers – WECS in various countries.

REFERENCES

1. L.L.Freris "Wind Energy conversion Systems", Prentice Hall, 1990.
2. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
3. E.W.Golding "The generation of Electricity by wind power", Redwood burn Ltd., Trowbridge, 1976.
4. S.Heir "Grid Integration of WECS", Wiley 1998.

Registrar