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* Common to all B.E. / B.Tech. Programmes

+ Offering English Language Laboratory as an additional subject (with no marks) during 2nd semester may be decided by the respective Colleges affiliated to Anna University Chennai.

A. CIRCUIT BRANCHES

I Faculty of Electrical Engineering
1. B.E. Electrical and Electronics Engineering
2. B.E. Electronics and Instrumentation Engineering
3. B.E. Instrumentation and Control Engineering

II Faculty of Information and Communication Engineering
1. B.E. Computer Science and Engineering
2. B.E. Electronics and Communication Engineering
3. B.E. Bio Medical Engineering
4. B.Tech. Information Technology

B. NON – CIRCUIT BRANCHES

I Faculty of Civil Engineering
1. B.E. Civil Engineering

II Faculty of Mechanical Engineering
1. B.E. Aeronautical Engineering
2. B.E. Automobile Engineering
3. B.E. Marine Engineering
4. B.E. Mechanical Engineering
5. B.E. Production Engineering

III Faculty of Technology
1. B.Tech. Chemical Engineering
2. B.Tech. Biotechnology
3. B.Tech. Polymer Technology
4. B.Tech. Textile Technology
5. B.Tech. Textile Technology (Fashion Technology)
7. B.Tech. Plastics Technology
# SEMESTER III
(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

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<td>EE2029</td>
<td>System Identification and Adaptive Control</td>
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<td>EE2030</td>
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<td>High Voltage Direct Current Transmission</td>
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<td>17.</td>
<td>GE2023</td>
<td>Fundamental of NanoScience</td>
<td>3</td>
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<td>18.</td>
<td>EE2033</td>
<td>Micro Electro Mechanical Systems</td>
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<td>19.</td>
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<td>Software for Circuit Simulation</td>
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<td>EE2035</td>
<td>Computer Aided Design of Electrical Apparatus</td>
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<td>EE2036</td>
<td>Flexible AC Transmission Systems</td>
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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
12
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 and predicting the content – Reading advertisements and interpretation.

UNIT II
12

SUGGESTED ACTIVITIES:
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.
1. Listening comprehension exercises to categorise data in tables.
2. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits – Writing analytical paragraphs on different debatable issues.

UNIT III
12
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:
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)
1. Speaking exercises involving the use of stress and intonation – Group discussions – analysis of problems and offering solutions.
2. Reading comprehension exercises with critical questions, Multiple choice question.

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.

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.

TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES:
EXTENSIVE READING:

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.

MA2161 MATHEMATICS – II

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 12
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 12

UNIT III ANALYTIC FUNCTIONS 12
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 12

UNIT V LAPLACE TRANSFORM 12

TOTAL : 60 PERIODS

TEXT BOOK:
REFERENCES:

PH2161 ENGINEERING PHYSICS – II

UNIT I CONDUCTING MATERIALS 9

UNIT II SEMICONDUCTING MATERIALS 9

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9
Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

UNIT V MODERN ENGINEERING MATERIALS 9
Metallic glasses: preparation, properties and applications.

TOTAL : 45 PERIODS
TEXT BOOKS:
2. Charles P. Poole and Frank J.Ownen, ‘Introduction to Nanotechnology’, Wiley India(2007) (for Unit V)

REFERENCES:

CY2161 ENGINEERING CHEMISTRY – II L T P C
3 0 0 3

AIM
To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES
• The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
• Principles of corrosion control
• Chemistry of Fuels and combustion
• Industrial importance of Phase rule and alloys
• Analytical techniques and their importance.

UNIT I ELECTROCHEMISTRY 9
Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes – Standard Hydrogen electrode Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox Fe²⁺ vs dichromate and precipitation – Ag⁺ vs Cl⁻ titrations) and conduct metric titrations (acid-base – HCl vs, NaOH) titrations,

UNIT II CORROSION AND CORROSION CONTROL 9

UNIT III FUELS AND COMBUSTION 9
UNIT IV  PHASE RULE AND ALLOYS

UNIT V  ANALYTICAL TECHNIQUES

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

ME2151  ENGINEERING MECHANICS  L T P C  3 1 0 4

OBJECTIVE
At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I  BASICS & STATICS OF PARTICLES  12

UNIT II  EQUILIBRIUM OF RIGID BODIES  12
UNIT III  PROPERTIES OF SURFACES AND SOLIDS  12

UNIT IV  DYNAMICS OF PARTICLES  12

UNIT V  FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS  12
Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TOTAL: 60 PERIODS

TEXT BOOK:

REFERENCES:

EE2151  CIRCUIT THEORY  LT P C
(Common to EEE, EIE and ICE Branches)  3 1 0 4

UNIT I  BASIC CIRCUITS ANALYSIS  12

UNIT II  NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS  12
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

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.

TOTAL : 60 PERIODS

TEXT BOOKS:

REFERENCES:

EC2151
ELECTRIC CIRCUITS AND ELECTRON DEVICES
(For ECE, CSE, IT and Biomedical Engg. Branches)
L T P C
3 1 0 4

UNIT I
CIRCUIT ANALYSIS TECHNIQUES

UNIT II
TRANSIENT RESONANCE IN RLC CIRCUITS

UNIT III
SEMICONDUCTOR DIODES
UNIT IV  TRANSISTORS
Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT V  SPECIAL SEMICONDUCTOR DEVICES
(Qualitative Treatment only)

TOTAL : 60 PERIODS

TEXT BOOKS:

REFERENCES:

GE2151  ASIC ELECTRICAL AND ELECTRONICS ENGINEERING  L T P C
(Common to branches under Civil, Mechanical and Technology faculty)  3 0 0 3

UNIT I  ELECTRICAL CIRCUITS & MEASUREMENTS
Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II  ELECTRICAL MECHANICS

UNIT III  SEMICONDUCTOR DEVICES AND APPLICATIONS
UNIT IV  DIGITAL ELECTRONICS  12
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops –
Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V  FUNDAMENTALS OF COMMUNICATION ENGINEERING  12
Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of
Amplitude and Frequency Modulations.
Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram
Approach only).

TOTAL : 60 PERIODS

TEXT BOOKS:

REFERENCES:

GE2152  BASIC CIVIL & MECHANICAL ENGINEERING  L T P C
(Common to branches under Electrical and I & C Faculty)  4 0 0 4
A – CIVIL ENGINEERING

UNIT I  SURVEYING AND CIVIL ENGINEERING MATERIALS  15
leveling – determination of areas – illustrative examples.


UNIT II  BUILDING COMPONENTS AND STRUCTURES  15
Foundations: Types, Bearing capacity – Requirement of good foundations.

plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges
and Dams – Basics of Interior Design and Landscaping.

TOTAL : 30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III  POWER PLANT ENGINEERING  10
Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric
and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of
Reciprocating pumps (single acting and double acting) – Centrifugal Pump.
UNIT IV  IC ENGINES  10
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  10

REFERENCES:

GE2155  COMPUTER PRACTICE LABORATORY – II  L T P C
LIST OF EXPERIMENTS  0 1 2 2

1. UNIX COMMANDS  15
   Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING  15
   Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX  15
   Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL : 45 PERIODS

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
LIST OF EXPERIMENTS

1. Determination of Young’s modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
5. Spectrometer dispersive power of a prism.
6. Determination of Young’s modulus of the material – uniform bending.

• A minimum of FIVE experiments shall be offered.
• Laboratory classes on alternate weeks for Physics and Chemistry.
• The lab examinations will be held only in the second semester.

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using BaCl₂ vs Na₂SO₄
4. Potentiometric Titration (Fe²⁺ / KMnO₄ or K₂Cr₂O₇)
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper sulphate)
7. Estimation of Ferric iron by spectrophotometry.

• A minimum of FIVE experiments shall be offered.
• Laboratory classes on alternate weeks for Physics and Chemistry.
• The lab examinations will be held only in the second semester.
LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Splint or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building ( Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

NOTE: PLOTTING OF DRAWINGS MUST BE MADE FOR EACH EXERCISE AND ATTACHED TO THE RECORDS WRITTEN BY STUDENTS.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

1. Pentium IV computer or better hardware, with suitable graphics facility - 30 No.
2. Licensed software for Drafting and Modeling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.

LIST OF EXPERIMENTS

1. Verification of ohm’s laws and kirchoff’s laws.
2. Verification of Thewemin’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.
10. Frequency response of single tuned coupled circuits.

TOTAL: 45 PERIODS
1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET

TOTAL : 45 PERIODS

10. ENGLISH LANGUAGE LABORATORY (Optional)

1. LISTENING: 5
   Listening & answering questions – gap filling – Listening and Note taking- Listening to telephone conversations

2. SPEAKING: 5
   Pronouncing words & sentences correctly – word stress – Conversation practice.

CLASSROOM SESSION 20
   1. Speaking: Introducing oneself, Introducing others, Role play, Debate -Presentations:
      Body language, gestures, postures.
      Group Discussions etc
   2. Goal setting – interviews – stress time management – situational reasons

EVALUATION
   (1) Lab Session – 40 marks
       Listening – 10 marks
       Speaking – 10 marks
       Reading – 10 marks
       Writing – 10 marks
   (2) Classroom Session – 60 marks
       Role play activities giving real life context – 30 marks
       Presentation – 30 marks

NOTE ON EVALUATION
1. Examples for role play situations:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.
2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.
REFERENCES:

LAB REQUIREMENTS
1. Teacher – Console and systems for students
2. English Language Lab Software
3. Tape Recorders.

MA2211 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (Common to all branches) L T P C 3 1 0 4

OBJECTIVES
The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential 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.

UNIT I FOURIER SERIES

UNIT II FOURIER TRANSFORM

UNIT III 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.

UNIT IV 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.

UNIT V Z-TRANSFORM AND DIFFERENCE EQUATIONS

TUTORIALS = 15 TOTAL = 60 PERIODS

TEXTBOOKS
EE2201 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.

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

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS

UNIT III COMPARISON METHODS OF MEASUREMENTS
D.C & A.C potentiometers, D.C & A.C bridges, transformer ratio bridges, self-balancing bridges.

Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES
Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS

L = 45 TOTAL :45 PERIODS
TEXT BOOKS

REFERENCES

EE2202 ELECTROMAGNETIC THEORY L T P C
3 1 0 4

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
i. Concepts of electrostatics, electrical potential, energy density and their applications.
ii. Concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
iii. Faraday’s laws, induced emf and their applications.
iv. Concepts of electromagnetic waves and Pointing vector.

UNIT I INTRODUCTION 8
Sources and effects of electromagnetic fields – Vector fields – Different co-ordinate systems- vector calculus – Gradient, Divergence and Curl - Divergence theorem – Stoke’s theorem.

UNIT II ELECTROSTATICS 10
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.

UNIT III MAGNETOSTATICS 9
UNIT IV  ELECTRODYNAMIC FIELDS

UNIT V  ELECTROMAGNETIC WAVES

L = 45   T = 15   TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES

GE 2211  ENVIRONMENTAL SCIENCE AND ENGINEERING  L T P C
3 0 0 3

(Common to EEE, EIE, ICE, Biotech, Chemical, Textile Tech.(Fashion Tech.) / Fashion Tech., Plastic Tech., Polymer Tech. & Textile Tech.)

OBJECTIVES
• To create an awareness on the various environmental pollution aspects and issues.
• To give a comprehensive insight into natural resources, ecosystem and biodiversity.
• To educate the ways and means to protect the environment from various types of pollution.
• To impart some fundamental knowledge on human welfare measures.

UNIT I  INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES
Definition, scope and importance – need for public awareness – forest resources: use and overexploitation, 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.

UNIT II  ECOSYSTEMS AND BIODIVERSITY  14
Concept 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, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT III  ENVIRONMENTAL POLLUTION  8
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 – solid 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

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT  7

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT  6

TEXT BOOKS:
REFERENCES:

EE2203 ELECTRONIC DEVICES AND CIRCUITS L T P C 3 0 0 3

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:

i) p-n junction diode
ii) Bipolar transistor
iii) Field effect transistor
iv) LED, LCD and other photo electronic devices
v) Power control / regulator devices

UNIT I PN DIODE AND ITS APPLICATIONS 9

UNIT II BJT AND ITS APPLICATIONS 9

UNIT III FET AND ITS APPLICATIONS 9

UNIT IV AMPLIFIERS AND OSCILLATORS 9

UNIT V PULSE CIRCUITS 9

TOTAL : 45 PERIODS
TEXT BOOKS:
2. David Bell “Electronic Devices and Circuits” 2007, PHI

REFERENCES:

EE2204 DATA STRUCTURES AND ALGORITHMS (Common to EEE, EIE & ICE) L T P C
3 1 0 4

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

UNIT V ALGORITHM DESIGN AND ANALYSIS

L : 15 TOTAL : 45 PERIODS

TEXT BOOKS
REFERENCES

EE2207  ELECTRON DEVICES AND CIRCUITS LABORATORY  L T P C
(B.E. (EEE), B.E. (E&I) and B.E. (I & C)  0 0 3 2
(Revised)

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 amplifiers using FET.
10. Study of CRO.

P: 45 TOTAL : 45 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
<th>Quantity available</th>
<th>Deficiency %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Regulated Power Supply</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Dual Tree CRO (20 MHz)</td>
<td>15</td>
<td></td>
<td></td>
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<tr>
<td>3.</td>
<td>Function Generator</td>
<td>15</td>
<td></td>
<td></td>
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<tr>
<td>4.</td>
<td>3½ Digit digital multimeter</td>
<td>10</td>
<td></td>
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<tr>
<td>5.</td>
<td>Bread Boards</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>JFET</td>
<td>10 Nos.</td>
<td></td>
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</tr>
</tbody>
</table>
EE2209 DATA STRUCTURES AND ALGORITHMS LABORATORY
(COMMON TO EEE, EIE & ICE) L T P C 0 0 3 2

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.
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.
15. Implement any randomized algorithm.

TOTAL: 45 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
<th>Quantity available</th>
<th>Deficiency %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Hardware Required</strong></td>
<td></td>
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</tr>
<tr>
<td>1.</td>
<td>Computer(Pentium 4)</td>
<td>40 Nos with one server</td>
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<tr>
<td>2.</td>
<td>Dot matrix printer</td>
<td>3 Nos</td>
<td></td>
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<tr>
<td>3.</td>
<td>Laser Printer</td>
<td>2 Nos</td>
<td></td>
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<tr>
<td>4.</td>
<td>UPS (5 KVA)</td>
<td>2</td>
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<tr>
<td><strong>Software Required</strong></td>
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<tr>
<td>5.</td>
<td>Turbo C</td>
<td>40 Nodes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EE2208  MEASUREMENTS AND INSTRUMENTATION LABORATORY**

**L T P C**

0 0 3 2

**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.
7. Calibration of single-phase energy meter.
9. Measurement of three phase power and power factor.

\[ P = 45 \text{ TOTAL } = 45 \text{ PERIODS} \]

**Detailed Syllabus**

1(a) **Study of Displacement Transducer - LVDT**

**AIM**
To study the operation of LVDT

**OBJECTIVES**
1. To study the basic principle of LVDT.
2. Study of signal conditioning circuit.
3. 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.

**EQUIPMENT**
1. LVDT kit – 1 No
2. Multimeter – 1 No

1(b) **Study of Pressure Transducer**
AIM
To study the operation of bourdon tube

OBJECTIVES
1. To study the basic principle of Bourdon tube.
2. 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 in terms of voltage or current.

EQUIPMENT
1. Bourdon pressure transducer kit – 1 No
2. Foot pump – 1 No
3. Voltmeter – 1 No
4. 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.

OBJECTIVES
1. To find the unknown inductance of the given coil using bridge circuit.
2. 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
1. Maxwell’s inductance Capacitance Bridge kit – 1 No
2. Multimeter – 1 No
3. Unknown Inductance – 1 No

B) SCHERING BRIDGE

AIM
To measure the unknown capacitance using Schering bridge.

OBJECTIVE
1. To measure the unknown capacitance.
2. 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
1. Schering Bridge kit – 1 No
2. Multimeter – 1 No
3. Unknown capacitance – 1 No

3. DC Bridges
   a) Wheat Stone Bridge

AIM
To measure the given medium resistance using Wheatstone Bridge.

OBJECTIVE
1. To study the working of bridge under balanced and unbalanced condition.
2. 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
1. Wheat stone Bridge kit – 1 No
2. Unknown resistance – 1 No
3. Multimeter – 1 No

b) KELVIN'S DOUBLE BRIDGE

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

Objective
1. To study the working of bridge under balanced and unbalance condition.
2. 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
1. Kelvin Double bridge kit – 1 No
2. Unknown resistance – 1 No
3. Multimeter – 1 No

4. Instrumentation Amplifier

Aim
To study the working of instrumentation amplifier.

Objective
1. To study the characteristic of operational amplifier.
2. 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
1. Operational Amplifier – 1 No
2. Resistors – 1 No
3. RPS – 1 No
4. Voltmeter – 1 No
5. Multimeter – 1 No

5(a) A/D Converter
Aim
To design and test a 4 bit A/D converter
1. Successive approximation type
2. Ramp type
Objective
1. To study the conversion of analog I/P voltage to digital o/p voltage.
2. To study the operation and characteristic of operational amplifier
Exercise
1. Given 4 bit analog input is converted to digital output
2. Verify the practical output with theoretical output

Equipment
1. IC 741 – 1 No
2. DC trainer kit – 1 No
3. RPS – 1 No
4. Resistor – 1 No
5. CRO – 1 No

(b) D/A Converter
Aim
To design and test a 4 bit D/A converter
1. Weighted resistor technique
2. R-2R ladder network
Objective
1. To study the conversion of binary voltage to analog o/p voltage
2. 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
1. IC 741 – 1 No
2. DC Trainer kit – 1 No
3. RPS – 1 No
6. **Study of Transients**

**Aim**
To study the transient response of the given system

**Objective**
1. To study the transient behaviour of the given system
2. 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**
1. Resistance – 1 No
2. Capacitance – 1 No
3. RPS – 1 No
4. Voltmeter – 1 No
5. 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**
1. To study the working of energy meter
2. To accurately calibrate the meter at unity and other power factor
3. 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**
1. Energy meter – 1 No
2. Wattmeter – 1 No
3. Stop watch – 1 No
4. M.I Ammeter – 1 No
5. M.I Voltmeter – 1 No

8. **Calibration of Current Transformer**

**Aim**
To study the working of current transformer

**Objective**
1. To study the current transformation concept
2. To study the efficiency of a given current transformer
3. 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
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**
1. To study the working of wattmeter
2. To accurately measure the 3 phase power
3. To accurately measure the power factor
4. 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**
1. 3 phase Auto transformer – 1 No
2. M.I Ammeter – 1 No
3. M.I Voltmeter – 1 No
4. Wattmeter – 1 No

10. **Measurement of Iron Loss (Maxwell Bridge)**

**Aim**
To determine the iron losses in magnetic material using bridge method

**Objective**
1. To study about hysteresis loss
2. To study about eddy current loss

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

**Equipment**
1. Maxwell bridge set up – 1 No
2. Ring specimen – 1 No
3. Ammeter – 1 No
4. Galvanometer – 1 No
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.

UNIT I  SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS  9

UNIT II  INTERPOLATION AND APPROXIMATION  9
Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton’s forward and backward difference formulas.

UNIT III  NUMERICAL DIFFERENTIATION AND INTEGRATION  9

UNIT IV  INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS  9

UNIT V  BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS  9
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.

L = 45   T = 15   TOTAL = 60 PERIODS
TEXT BOOKS

REFERENCES

EE 2251 ELECTRICAL MACHINES – I L T P C
3 1 0 4

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.

UNIT I INTRODUCTION

UNIT II TRANSFORMERS

UNIT III ELECTROMECHANICAL ENERGY CONVERSION
Energy in magnetic systems – field energy, coenergy and mechanical force – singly and multiply excited systems.

UNIT IV 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.
UNIT V  DC MACHINES

L = 45   T = 15   TOTAL = 60 PERIODS

TEXT BOOKS:

REFERENCES:

EE2252  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.

UNIT I  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- dearearators-cooling tower

UNIT II  HYDRO ELECTRIC POWER PLANTS
Layout-dams-selection of water turbines-types-pumped storage hydel plants

UNIT III  NUCLEAR POWER PLANTS
Principles of nuclear energy- Fission reactions-nuclear reactor-nuclear power plants

UNIT IV  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

UNIT V  NON-CONVENTIONAL POWER GENERATION
Solar energy collectors, OTEC, wind power plants, tidal power plants and geothermal resources, fuel cell, MHD power generation-principle, thermolectric power generation, thermionic power generation

L = 45   T = 15   TOTAL = 60 PERIODS

TEXT BOOKS
REFERENCES:
1. Power station Engineering and Economy by Bernhardt G.A.Skrotzki and William A. Vopat-
2. An introduction to power plant technology by G.D. Rai-Khanna Publishers, Delhi-
   110 005.

EE2253 CONTROL SYSTEMS (Common to EEE, EIE & ICE) 
L T P C 
3 1 0 4

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.

UNIT I SYSTEMS AND THEIR REPRESENTATION

UNIT II TIME RESPONSE

UNIT III FREQUENCY RESPONSE
Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

UNIT IV STABILITY OF CONTROL SYSTEM

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

L = 45  T = 15  TOTAL = 60 PERIODS
TEXT BOOKS

REFERENCES
3. Samarajit Ghosh, Control systems, Pearson Education, New Delhi, 2004

EE2254 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS L T P C
(Common to EEE, EIE & ICE) 3 0 0 3

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

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

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

UNIT II CHARACTERISTICS OF OPAMP
Ideal OP-AMP characteristics, DC characteristics, AC characteristics, 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.

UNIT III 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.

UNIT IV 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.

UNIT V 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.

L = 45 TOTAL = 45PERIODS
TEXT BOOKS

REFERENCES

EE2255 DIGITAL LOGIC CIRCUITS  L T P C
3 1 0 4

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

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

UNIT I BOOLEAN ALGEBRA AND COMBINATIONAL CIRCUITS  9

UNIT II SYNCHRONOUS SEQUENTIAL CIRCUITS  9
Flip flops - SR, D, JK and T. Analysis of synchronous sequential circuits; design of synchronous sequential circuits – Counters, state diagram; state reduction; state assignment.

UNIT III ASYNCHRONOUS SEQUENTIAL CIRCUIT  9
Analysis of asynchronous sequential machines, state assignment, asynchronous design problem.

UNIT IV PROGRAMMABLE LOGIC DEVICES, MEMORY AND LOGIC FAMILIES  9
Memories: ROM, PROM, EPROM, PLA, PLD, FPGA, digital logic families: TTL, ECL, CMOS.

UNIT V VHDL  9

L = 45 T = 15 TOTAL: 60 PERIODS
TEXT BOOKS

REFERENCES

EE2257    CONTROL SYSTEM LABORATORY    L T P C
0 0 3 2

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

P = 45    TOTAL : 45 PERIODS

DETAILS 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.
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**
1. AC Servo Motor : Minimum of 100w – necessary sources for main winding and control winding – 1 No
2. Tachometer : 1 No
3. Stopwatch : 1 No
4. 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**
1. Rigged up models of type-0 and type-1 system using analog components.
2. 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 $\tau$ and gain

**Equipment**
1. DC Generator
2. Tachometer
3. Various meters
4. Stop watch
5. **Determination of Transfer function of DC Motor**

**Aim**
To determine the transfer function of DC motor

**Exercise**
11. Obtain the transfer function of DC motor by calculating $\tau$ and gain

**Equipment**
1. DC Motor
2. Tachometer
3. Various meters
4. 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**
1. 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.
2. To measure outputs at various points (between stages)

**Equipment**
1. AC and DC position control kit with DC servo motor.
2. Power transistor
3. 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**
1. Stepping motor
2. Microprocessor kit
3. Interfacing card
4. 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**
System with MATLAB / MATHCAD (or) equivalent software - minimum 3 user license.

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**EE2258 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. (a) Code converters, Parity generator and parity checking, Excess-3, 2s Complement, Binary to Gray code using suitable IC’s.
   (b) 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.
   Study of 4:1; 8:1 multiplexer and Study of 1:4; 1:8 demultiplexer
Timer IC application:
Study of NE/SE 555 timer in Astable, Monostable operation.

Application of Op-Amp:
Slew rate verifications, inverting and non-inverting amplifier, Adder, comparator, Integrater and Differentiator.

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

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.

P = 45 TOTAL = 45 PERIODS

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
   1. Realization of functions using SOP, POS, form.
   2. Addition, Subtraction of atleast 3 bit binary number using basic gate IC’ s.

3a) 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
   1. Conversion Binary to Grey, Grey to Binary;
   2. 1’s. 2’s complement of numbers addition, subtraction,
   2. Parity checking of numbers using Gates and with dedicated IC’s

3b) Encoders and Decoders: Decimal and Implementation of 4-bit shift registers in SISO, SIPO,PISO,PIPO modes using suitable ICs.
   Exercise
   1. Decimal to binary Conversion using dedicated ICs.
   2. 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.

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 multivibrator & monostable multivibrator 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

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
<th>Quantity available</th>
<th>Deficiency %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Interface such as, A/D, D/A converter, DMA, PIC Serial, Interface, Temperatures controller, Stepper motor, Key board</td>
<td>4 each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>CRO and function generator</td>
<td>3 each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>IC trainer Kit</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Analog AC trainer kit</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Components and bread boards</td>
<td>10 each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Chips IC – 7400</td>
<td>10</td>
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</tr>
<tr>
<td>7.</td>
<td>Chips IC – 7402</td>
<td>10</td>
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</tr>
<tr>
<td>8.</td>
<td>Chips IC – 7408</td>
<td>10</td>
<td></td>
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</tr>
<tr>
<td>9.</td>
<td>Chips IC – 7432</td>
<td>10</td>
<td></td>
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</tr>
<tr>
<td>S.No.</td>
<td>Description of Equipment</td>
<td>Quantity required</td>
<td>Quantity available</td>
<td>Deficiency %</td>
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<tr>
<td>-------</td>
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<tr>
<td>10.</td>
<td>Chips IC – 7410</td>
<td>25</td>
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<tr>
<td>11.</td>
<td>Chips IC – 555</td>
<td>10</td>
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<tr>
<td>12.</td>
<td>Chips IC – 741</td>
<td>10</td>
<td></td>
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<tr>
<td>13.</td>
<td>Chips IC – 74153</td>
<td>10</td>
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</tr>
<tr>
<td>14.</td>
<td>Chips IC – 7474</td>
<td>10</td>
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<tr>
<td>15.</td>
<td>Chips IC – 7490</td>
<td>10</td>
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</tr>
<tr>
<td>16.</td>
<td>Chips IC – 7447</td>
<td>10</td>
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<tr>
<td>17.</td>
<td>Chips IC – 7476</td>
<td>10</td>
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<tr>
<td>18.</td>
<td>Chips IC – 7420</td>
<td>10</td>
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<tr>
<td>19.</td>
<td>Chips IC – 7404</td>
<td>15</td>
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</tr>
<tr>
<td>20.</td>
<td>Chips LM – 317</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>Chips LM – 723</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Chips MA – 7840</td>
<td>10</td>
<td></td>
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</tr>
<tr>
<td>23.</td>
<td>Chips LM – 380</td>
<td>10</td>
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</tr>
<tr>
<td>24.</td>
<td>Chips ICL - 8038</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>Traffic light control kit</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>VDU</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>7 segment Display</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>Interfacing card such as keyboard etc.</td>
<td>3 each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>Work tables</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.
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.

TOTAL: 45 PERIODS

Requirement for a batch of 30 students

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
<th>Quantity available</th>
<th>Deficiency %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>D.C motor – Generator set</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.C motor – Shunt Generator</td>
<td>2 set</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.C motor – Compound Generator</td>
<td>2 set</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Single phase transformers</td>
<td>7 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Three phase transformers</td>
<td>2 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>D.C. Motor – Alternator set</td>
<td>4 sets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Three phase Induction Motor (Squirrel cage)</td>
<td>3 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Resistive load</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 phase – 2 , single phase - 3</td>
<td>5 Nos.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12.</td>
<td>Inductive load</td>
<td>1 No.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Three phase Auto transformer</td>
<td>3 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Moving Coil Ammeter of different ranges</td>
<td>20 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Moving Coil Voltmeter of different ranges</td>
<td>20 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Moving Iron Ammeter of different ranges</td>
<td>20 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Moving Iron voltmeter of different ranges</td>
<td>20 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Wire wound Rheostats of different ratings</td>
<td>30 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Tachometers</td>
<td>10 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Double element wattmeters of different ranges</td>
<td>4 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Power factor meter</td>
<td>2 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>Digital multimeter</td>
<td>5 Nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>Three point starter, four point starter, DOL starter, manual star / delta starter, semi automatic and fully automatic star / delta starter</td>
<td>1 No each for study experiment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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

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)

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

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

EC2314  DIGITAL SIGNAL PROCESSING
L T P C 3 1 0 4
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

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

L = 45   T = 15   TOTAL = 60 PERIODS

TEXT BOOKS

CS2311 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 messages-abstraction and encapsulation-inheritance- abstract classes- polymorphism. Introduction to C++- objects-classes-constructors and destructors

UNIT II

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

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

EE2301 POWER ELECTRONICS L T P C 3 0 0 3

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 topologies 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  

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 120° mode and 180° 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.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

EE 2302  ELECTRICAL MACHINES - II  L T P C  3 1 0 4

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

OBJECTIVES
To impart knowledge on
i. Construction and performance of salient and non – salient type synchronous generators.
iii. Construction, principle of operation and performance of induction machines.
iv. Starting and speed control of three-phase induction motors.
UNIT I  SYNCHRONOUS GENERATOR

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

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

L = 45  T = 15  TOTAL = 60 PERIODS

TEXT BOOKS

REFERENCES

EE2303  TRANSMISSION AND DISTRIBUTION  L T P C
3 1 0 4

AIM
To understand the importance and the functioning of transmission and distribution of the 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-a-half 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.

L=45  T = 15  TOTAL = 60PERIODS

TEXT BOOKS
REFERENCES

CS2311 OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

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 messages-abstraction and encapsulation-inheritance- abstract classes- polymorphism.Introduction to C++- objects-classes-constructors and destructors

UNIT II

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

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
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

TOTAL : 45 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Hardware Required</strong></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Computers (Pentium-4)</td>
<td>40 Nos with one server</td>
</tr>
<tr>
<td>2.</td>
<td>Dot matrix printer</td>
<td>3 Nos</td>
</tr>
<tr>
<td>3.</td>
<td>Laser Printer</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>4.</td>
<td>UPS (5 KVA)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Software Required</strong></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Turbo C++</td>
<td>40 Nodes</td>
</tr>
<tr>
<td>6.</td>
<td>(Java 2 SDK)</td>
<td>40 Nos.</td>
</tr>
<tr>
<td></td>
<td>JDK 5.0 update 6 (1.5.0 - Internal Version No.)</td>
<td>40 Nos.</td>
</tr>
</tbody>
</table>
Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students’ overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES:

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

I. PC based session  (Weightage 40%)  24 periods

A. English Language Lab  (18 Periods)

1. Listening Comprehension: 6
   Listening and typing – Listening and sequencing of sentences – Filling in the blanks -Listening and answering questions.

2. Reading Comprehension: 6
   Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. Speaking: 6
   Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. Viewing and discussing audio-visual materials  (6 periods)
   (Samples are available to learn and practice)

1. Resume / Report Preparation / Letter Writing  1
   Structuring the resume / report - Letter writing / Email Communication - Samples.

2. Presentation skills:  1
   Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples
3. **Soft Skills:**
   Time management – Articulateness – Assertiveness – Psychometrics – Inovation and Creativity - Stress Management & Poise - Video Samples

4. **Group Discussion:**
   Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD - Video samples

5. **Interview Skills:**
   Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews-Video samples.

---

### II. Practice Session

<table>
<thead>
<tr>
<th>Description of Equipment</th>
<th>Quantity required</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resume / Report Preparation / Letter writing:</strong> Students prepare their own resume and report.</td>
<td>(2)</td>
</tr>
<tr>
<td><strong>Presentation Skills:</strong> Students make presentations on given topics.</td>
<td>(8)</td>
</tr>
<tr>
<td><strong>Group Discussion:</strong> Students participate in group discussions.</td>
<td>(6)</td>
</tr>
<tr>
<td><strong>Interview Skills:</strong> Students participate in Mock Interviews</td>
<td>(8)</td>
</tr>
</tbody>
</table>

---

### REFERENCES:


---

**Lab Requirements:**

1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

---

**Requirement for a batch of 60 students**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Server</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>o PIV system</td>
<td></td>
</tr>
<tr>
<td><strong>2. Client Systems</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>o PIII or above</td>
<td>60 No.</td>
<td></td>
</tr>
<tr>
<td>o 256 or 512 MB RAM / 40 GB HDD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o OS: Win 2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o Audio card with headphones (with mike)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o JRE 1.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **3. Handicam Video Camera (with video lights and mic input)** | 1 No. |

| **4. Television - 29”** | 1 No. |

| **5. Collar mike** | 1 No. |

| **6. Cordless mikes** | 1 No. |

| **7. Audio Mixer** | 1 No. |

| **8. DVD Recorder / Player** | 1 No. |

| **9. LCD Projector with MP3 /CD /DVD provision for audio / video facility - Desirable** | 1 No. |

EE2304  POWER ELECTRONICS LABORATORY  L T P C  0 0 3 2

**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

**TOTAL : 45 PERIODS**
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Device characteristics (for SCR, MOSFET, TRIAC and IGBT) kit with built in power supply &amp; meters</td>
<td>2 each</td>
</tr>
<tr>
<td>2.</td>
<td>SCR firing circuit module</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Single phase SCR based ½ controlled converter &amp; fully controlled converter along with built-in / separate / firing circuit / module and meter</td>
<td>2 each</td>
</tr>
<tr>
<td>4.</td>
<td>MOSFET based step up and step down choppers</td>
<td>1 each</td>
</tr>
<tr>
<td>5.</td>
<td>IGBT based single phase PWM inverter module</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>IGBT based three phase PWM inverter module</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>IGBT based high switching frequency chopper module with built-in controller</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>Resonant DC-DC convertor module with built in power supply and controller</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>SCR &amp; TRIAC based 1 phase A.C.phase controller along with lamp or rheostat load</td>
<td>4</td>
</tr>
<tr>
<td>10.</td>
<td>SCR based V/I commuted chopper module with relevant firing module (separate or built-in)</td>
<td>4</td>
</tr>
<tr>
<td>11.</td>
<td>Dual regulated DC power supply with common ground</td>
<td>4</td>
</tr>
<tr>
<td>12.</td>
<td>Cathode Ray Oscilloscope</td>
<td>5</td>
</tr>
<tr>
<td>13.</td>
<td>Isolation Transformer</td>
<td>5</td>
</tr>
<tr>
<td>14.</td>
<td>Single phase Auto transformer</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>Components (Inductance, Capacitance)</td>
<td>3 sets for each</td>
</tr>
<tr>
<td>16.</td>
<td>Multi meter</td>
<td>5</td>
</tr>
<tr>
<td>17.</td>
<td>LCR meter</td>
<td>3</td>
</tr>
<tr>
<td>18.</td>
<td>Rheostats of various ranges</td>
<td>2 sets of 10 value</td>
</tr>
<tr>
<td>19.</td>
<td>Work tables</td>
<td>12</td>
</tr>
<tr>
<td>20.</td>
<td>DC and AC metes of required ranges</td>
<td>20</td>
</tr>
</tbody>
</table>
**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.
7. No load and blocked rotor test on three-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.

**TOTAL: 45 PERIODS**

**REQUIREMENT FOR A BATCH OF 30 STUDENTS**

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

EE2351 POWER SYSTEM ANALYSIS L T P C 3 1 0 4

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
i. To model the power system under steady state operating condition. To apply efficient numerical methods to solve the power flow problem.
ii. To model and analyse the power systems under abnormal (or) fault conditions.
iii. 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
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


TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

EE2352  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 motor-load 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  9
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  9
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  9
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  9
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.

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:

EE 2353  HIGH VOLTAGE ENGINEERING  L T P C
3 0 0 3

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

UNIT I  OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS  6
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  10
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  10
Generation of High DC, AC, impulse voltages and currents. Tripping and control of impulse
generators.

UNIT IV  MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS  10
Measurement of High voltages and High currents – Digital techniques in high voltage measurement.

UNIT V  HIGH VOLTAGE TESTING & INSULATION COORDINATION  9
High voltage testing of electrical power apparatus – Power frequency, impulse voltage and DC
testing – International and Indian standards – Insulation Coordination.

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES:

EE2354  MICROPROCESSORS AND MICRO CONTROLLER  L T P C
3 0 0 3

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

OBJECTIVES
i. To study the Architecture of 8085 & 8086, 8051
ii. To study the addressing modes & instruction set of 8085 & 8051.
iii. To introduce the need & use of Interrupt structure 8085 & 8051.
iv. To develop skill in simple program writing for 8051 & 8085 and applications
v. To introduce commonly used peripheral / interfacing ICs

UNIT I  8085 and 8086 PROCESSOR  9
Hardware Architecture pintouts - Signals – Memory interfacing – I/O ports and data transfer concepts

UNIT II  PROGRAMMING OF 8085 PROCESSOR  9
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

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.

L = 45   T = 15   TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES

EE2355  DESIGN OF ELECTRICAL MACHINES  L T P C
3 1 0 4

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

UNIT I  INTRODUCTION
UNIT II  DC MACHINES  

UNIT III  TRANSFORMERS  

UNIT IV  INDUCTION MOTORS  

UNIT V  SYNCHRONOUS MACHINES  

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
UNIT III

UNIT IV

UNIT V

TEXT BOOK:

REFERENCES:

EE2356 MICROPROCESSOR AND MICRO CONTROLLER LABORATORY

AIM
1. To understand programming using instruction sets of processors.
2. To study various digital & linear

8-bit Microprocessor
1. Simple arithmetic operations: Multi precision addition / subtraction / multiplication / division.
3. Interface Experiments:
   • A/D Interfacing.
   • D/A Interfacing.
   • Traffic light controller.
4. Interface Experiments:
   • Simple experiments using 8251, 8279, 8254.

8-bit Microcontroller
5. Demonstration of basic instructions with 8051 Micro controller execution, including:
   • Conditional jumps, looping
- Calling subroutines.
- Stack parameter testing

6. Parallel port programming with 8051 using port 1 facility:
   - Stepper motor and D/A converter.

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

8. Implementation of Boolean Functions, Adder / Subtractor circuits.

9. Combination Logic; Adder, Subtractor, Code converters, Encoder and Decoder,

10. Sequential Logic; Study of Flip-Flop, Counters (synchronous and asynchronous), Shift Registers


12. Op-amp Non Linear Application; Clipper, Clamper, Peak detector, Timer IC application, VCO and PLL.

**TOTAL : 45 PERIODS**

### REQUIREMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>IC number/code</th>
<th>Quantity required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>8085 Microprocessor Trainer with Power supply</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>2.</td>
<td>8051 Micro controller Trainer Kit with power supply</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>3.</td>
<td>8255 Interface board</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>8251 Interface board</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>8259 Interface board</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>6.</td>
<td>8279 Keyboard/Display Interface Board</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>7.</td>
<td>8254 timer counter</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>8.</td>
<td>ADC and DAC card</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>9.</td>
<td>Stepper motor with Controller</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>10.</td>
<td>Traffic Light Control System</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>11.</td>
<td>Regulation power supply</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>12.</td>
<td>Universal ADD-ON modules</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>13.</td>
<td>8 Digit Multiplexed Display Card</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>14.</td>
<td>Function Generator</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Model</td>
<td>Quantity</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td>15.</td>
<td>Multimeter</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td>16.</td>
<td>C R O</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>17.</td>
<td>Quad 2-input AND gate</td>
<td>7408</td>
<td>50</td>
</tr>
<tr>
<td>18.</td>
<td>Quad 2-input OR gate</td>
<td>7432</td>
<td>50</td>
</tr>
<tr>
<td>19.</td>
<td>Quad 2-input XOR gate</td>
<td>7486</td>
<td>50</td>
</tr>
<tr>
<td>20.</td>
<td>Hex inverter/ NOT gate</td>
<td>7404</td>
<td>50</td>
</tr>
<tr>
<td>21.</td>
<td>Quad 2-input NOR gate</td>
<td>7402</td>
<td>50</td>
</tr>
<tr>
<td>22.</td>
<td>Quad 2-input NAND gate</td>
<td>7400</td>
<td>50</td>
</tr>
<tr>
<td>23.</td>
<td>Dual J-K flip Flop with clear</td>
<td>7473</td>
<td>50</td>
</tr>
<tr>
<td>24.</td>
<td>Dual D flip Flop with clear / preset</td>
<td>7474</td>
<td>50</td>
</tr>
<tr>
<td>25.</td>
<td>4 – bit Adder</td>
<td>7483</td>
<td>50</td>
</tr>
<tr>
<td>26.</td>
<td>4- bit Magnitude comparator</td>
<td>7485</td>
<td>50</td>
</tr>
<tr>
<td>27.</td>
<td>BCD to 7-segment code converter</td>
<td>7447</td>
<td>50</td>
</tr>
<tr>
<td>28.</td>
<td>3 to 8 Decoder / Demultiplexer</td>
<td>74138</td>
<td>50</td>
</tr>
<tr>
<td>29.</td>
<td>Decade / Modulo- n counter</td>
<td>7490</td>
<td>50</td>
</tr>
<tr>
<td>30.</td>
<td>4 – bit serial / parallel in/out shift register</td>
<td>7495</td>
<td>50</td>
</tr>
<tr>
<td>31.</td>
<td>General purpose OPAMP</td>
<td>741</td>
<td>100</td>
</tr>
<tr>
<td>32.</td>
<td>Timer</td>
<td>555</td>
<td>100</td>
</tr>
<tr>
<td>33.</td>
<td>Voltage Controlled Oscillator (VCO)</td>
<td>566</td>
<td>25</td>
</tr>
<tr>
<td>34.</td>
<td>Phase Locked Loop (PLL)</td>
<td>565</td>
<td>25</td>
</tr>
<tr>
<td>35.</td>
<td>Diode</td>
<td>IN4007</td>
<td>25</td>
</tr>
<tr>
<td>36.</td>
<td>Zener diode</td>
<td>5 volt</td>
<td>25</td>
</tr>
<tr>
<td>37.</td>
<td>Light Emitting Diode (LED)</td>
<td>LED</td>
<td>25</td>
</tr>
<tr>
<td>38.</td>
<td>Resistors (quarter watt) : 10K, 33k ohm</td>
<td>-</td>
<td>50 each</td>
</tr>
<tr>
<td>39.</td>
<td>Capacitors : 0, 1uF, 0.01uF, 0.47uF</td>
<td>-</td>
<td>50 each</td>
</tr>
<tr>
<td>40.</td>
<td>Bread Board</td>
<td>-</td>
<td>30</td>
</tr>
</tbody>
</table>
EE2357  PRESENTATION SKILLS AND TECHNICAL SEMINAR  L T P C  0 0 2 1

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.

EE2401  POWER SYSTEM OPERATION AND CONTROL  L T P C  3 0 0 3

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:
i. To have an overview of power system operation and control.
ii. To model power-frequency dynamics and to design power-frequency controller.
iii. 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  9
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  9
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 - tap-changing 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  UNIT COMMITMENT AND ECONOMIC DISPATCH

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.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
3. Hadi Saadat, “Power System Analysis”, (For the chapters 1, 2, 3 and 4)11th Reprint 2007.
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:
i. To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
ii. To understand the characteristics and functions of relays and protection schemes.
iii. 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:

REFERENCES:
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
i. Construction, principle of operation and performance of synchronous reluctance motors.
iii. Construction, principle of operation, control and performance of switched reluctance motors.

UNIT I  SYNCHRONOUS RELUCTANCE MOTORS  9

UNIT II  STEPPING MOTORS  9

UNIT III  SWITCHED RELUCTANCE MOTORS  9

UNIT IV  PERMANENT MAGNET BRUSHLESS D.C. MOTORS  9

UNIT V  PERMANENT MAGNET SYNCHRONOUS MOTORS  9

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
UNIT I  OVERVIEW OF MANAGEMENT  

UNIT II  PLANNING  

UNIT III  ORGANIZING  

UNIT IV  DIRECTING  
Creativity and Innovation - Motivation and Satisfaction - Motivation Theories Leadership - Leadership theories - Communication - Hurdles 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.

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:

CS2411  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

UNIT II PROCESS SCHEDULING AND SYNCHRONIZATION

UNIT III STORAGE MANAGEMENT

UNIT IV FILE SYSTEMS

UNIT V I/O SYSTEMS

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

EE2404 POWER SYSTEM SIMULATION LABORATORY L T P C
0 0 3 2

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.
   c) Unit Commitment and Economic Dispatch.

ii. To acquire experience in the usage of standard packages for the following analysis / simulation / control functions.
   d) Steady-state analysis of large system using NRPF and FDPF methods.
   e) Quasi steady-state (Fault) analysis for balanced and unbalanced faults.
   f) Transient stability simulation of multimachine power system.
   g) 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.
5. Fault Analysis
7. Transient Stability Analysis of Multimachine Power Systems
8. Electromagnetic Transients in Power Systems

TOTAL : 45 PERIODS

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
   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.

   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.

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 \( \Pi \) model.

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.

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 $V_{gi}$ over the range 1.00 to 1.05
   (iii) Changing the tap setting of the transformers, $a_i$, 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

4. 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 Carry out 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, state-of-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 TWO-AREA 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 \( K_I \) (gain of the controller) and choose the best value of \( K_I \) 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 load-frequency 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

85
(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 co-ordination 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

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Personal computers (Pentium-IV, 80GB, 512 MBRAM)</td>
<td>25</td>
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<tr>
<td>2.</td>
<td>Printer laser</td>
<td>1</td>
</tr>
</tbody>
</table>

86
3. Dotmatrix

4. Server (Pentium IV, 80GB, 1GBRAM) (High Speed Processor)

5. Software: E.M.T.P/ETAP/CYME/MIPOWER /any power system simulation software

6. Compliers: C, C++, VB, VC++

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**EE 2405**  
**COMPREHENSION**

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

**EE2451**  
**ELECTRIC ENERGY GENERATION, 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**

**UNIT II**  
**ECONOMIC ASPECTS OF GENERATION**

**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 ELECrtIC TRACTION 9
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.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

EI2404 FIBRE OPTICS AND LASER INSTRUMENTS L T P C
3 0 0 3

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

OBJECTIVES
i. To expose the students to the basic concepts of optical fibres and their properties.
ii. To provide adequate knowledge about the Industrial applications of optical fibres.
iii. To expose the students to the Laser fundamentals.
iv. To provide adequate knowledge about Industrial application of lasers.
v. To provide adequate knowledge about holography and Medical applications of Lasers.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

UNIT III LASER FUNDAMENTALS 9

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9
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  9

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

CS2070  VISUAL LANGUAGES AND APPLICATIONS  L T P C  3 0 0 3

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  9

UNIT II  RESOURCES AND CONTROLS  9
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
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


UNIT V DATABASE PROGRAMMING WITH VB
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.

L = 45   T = 15   TOTAL = 60PERIODS

TEXT BOOKS:

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

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

UNIT I  STATE VARIABLE ANALYSIS

UNIT II  PHASE PLANE ANALYSIS

UNIT III  DESCRIBING FUNCTION ANALYSIS

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

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

EE2023  ROBOTICS AND AUTOMATION  L T P C
3 0 0 3

AIM
To provide comprehensive knowledge of robotics in the design, analysis and control point of view.
OBJECTIVES
i. To study the various parts of robots and fields of robotics.
ii. To study the various kinematics and inverse kinematics of robots.
iii. To study the Euler, Lagrangian formulation of Robot dynamics.
iv. To study the trajectory planning for robot.
v. 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 –
lar ser – 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
Multiple robots – machine interface – robots in manufacturing and non-manufacturing applications –
robot cell design – selection of robot.

TOTAL : 45 PERIODS

TEXT BOOKS
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,

REFERENCES
Prentice Hall of India, New Delhi, 1994.
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 
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

TOTAL : 45 PERIODS

TEXT BOOKS :
(2005).

REFERENCES:
Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, 
New Delhi, (2004)

EE2027  POWER SYSTEM TRANSIENTS  
L T P C  3 0 0 3

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

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.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

EI2311  BIOMEDICAL 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:
i. To provide an acquaintance of the physiology of the heart, lung, blood circulation and
circulation respiration. Biomedical applications of different transducers used.

ii. To introduce the student to the various sensing and measurement devices of electrical origin. To provide awareness of electrical safety of medical equipments

iii. To provide the latest ideas on devices of non-electrical devices.

iv. To bring out the important and modern methods of imaging techniques.

v. To provide latest knowledge of medical assistance / techniques and therapeutic equipments.

UNIT I      PHYSIOLOGY AND TRANSDUCERS


UNIT II     ELECTRO – PHYSIOLOGICAL MEASUREMENTS


Electrical safety in medical environment: shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipments

UNIT III    NON-ELECTRICAL PARAMETER MEASUREMENTS


UNIT IV     MEDICAL IMAGING


UNIT V      ASSISTING AND THERAPEUTIC EQUIPMENTS


TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  INTRODUCTION

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

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

EE2026  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
i. To review the modeling of synchronous machine, the excitation system and speed-governing controllers.

ii. To study small signal stability analysis of a single-machine infinite bus system with excitation system and power system stabilizer.

iii. 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 - distinction between transient and dynamic stability - complexity of stability problem in large system – necessity for reduced models - stability of interconnected systems.

UNIT II SYNCHRONOUS MACHINE MODELLING
Synchronous machine - flux linkage equations - Park’s transformation - per unit conversion - normalizing the equations - equivalent circuit - current space model - flux linkage state space model. 
Sub-transient and transient inductances - time constants.

Simplified models (one axis and constant flux linkage) - steady state equations and phasor diagrams.

UNIT III MACHINE CONTROLLERS
Exciter and voltage regulators - function and types of excitation systems - typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit.

Function of speed governing systems - block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

UNIT IV TRANSIENT STABILITY
State equation for multimachine system with one axis model and simulation – modelling 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

TOTAL: 45 PERIODS

TEXT BOOKS


REFERENCES

CS2071 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

TEXT BOOKS:

REFERENCES:

GE2022 TOTAL QUALITY MANAGEMENT

UNIT I INTRODUCTION

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

UNIT IV TQM TOOLS & TECHNIQUES II

UNIT V QUALITY SYSTEMS

TOTAL : 45 PERIODS

TEXT BOOK

REFERENCES

EE2028 POWER QUALITY L T P C
3 0 0 3

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

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

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


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.

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES:
4. PSCAD User Manual

EE2029 SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL L T P C
3 0 0 3
UNIT I PARAMETRIC METHODS 5
Nonparametric methods: Transient analysis-frequency analysis-Correlation analysis- Spectral analysis.

UNIT II PARAMETRIC METHODS 10
Linier Regression: The Lease square estimate-best liner unbiased estimation under linear constraints- updating the Parameter estimates for linear regression models-Prediction error methods: Description of Prediction error methods-Optimal Prediction – relationships between Prediction error methods and other identification methods-theoretical analysis.
Instrumental variable methods: description of Instrumental variable methods-theoretical analysis-analysis of covariance matrix of IV estimates- Comparison of optimal IV prediction error methods.

UNIT III RECURSIVE IDENTIFICATION METHODS 10
The recursive lest squares method-the recursive Instrument variable method-the recursive prediction error method-model validation and model structure determination.

UNIT IV ADAPTIVE CONTROL SCHEMES 10

UNIT V ISSUES IN ADAPTIVE CONTROL AND APPLICATION 10
Stability – Convergence – Robustness – Application of adaptive control.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

EE2030 OPERATIONS RESEARCH

L T P C
3 0 0 3

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  9
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 – alternative optima – unbounded and/or Infeasible
Solution – redundancies.

UNIT II  PROBLEM FORMULATION  9
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  9
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  9
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  9
PERT and CPM for Project Scheduling – Resource Planning - Case Studies.

TOTAL : 45 PERIODS

TEXT BOOKS
Hall of India Edition, Asia, 2002. (For All Chapters 1, 2, 3, 4 and 5)

REFERENCES
2.  JIT.S Chandran, Mahendran P.Kawatra Ki Ho Kim ,"Essential of Linear Programming", Vikas
(For all Chapters 1, 2, 3, 4 and 5)
John Wiley, 1987
Edition, (For All Chapters)

EI2403  VLSI DESIGN  L T P C
3 0 0 3

AIM
To understand the 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  9
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  9

UNIT III  SUB SYSTEM DESIGN & LAYOUT  9

UNIT IV  DESIGN OF COMBINATIONAL ELEMENTS & REGULAR ARRAYLOGIC  9
NMOS PLA – Programmable Logic Devices - Finite State Machine PLA – Introduction to FPGA, CPLD.

UNIT V  VHDL PROGRAMMING  9

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
OBJECTIVE
i. To understand the concept, planning of DC power transmission and comparison with AC power transmission.
ii To analyze HVDC converters.
iii To study about compounding and regulation.
iv To analyze harmonics and design of filters.
v 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

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

UNIT V HVDC CABLES AND SIMULATION OF HVDC SYSTEMS

TOTAL : 45 PERIODS

TEXT BOOK

REFERENCES
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-
utilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, ptical,
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  CHARACTERIZATION TECHNIQUES
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission
Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM,
STM, SNOM, ESCA, SIMS-Nanoindentation.

TOTAL : 45 PERIODS

TEXT BOOKS
1. A.S. Edelstein and R.C. Cammearata, eds., Nanomaterials: Synthesis, Properties and
2. N John Dinardo, Nanoscale characterisation of surfaces & Interfaces, Second edition,
   Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES
1. G Timp (Editor), Nanotechnology, AIP press/ Springer, 1999
   Structure”, Theory, Modeling and Simulations. Prentice-Hall of India (P) Ltd, New
   Delhi, 2007.

EE2033  MICRO ELECTRO MECHANICAL SYSTEMS

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
(i) integrate the knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
(ii) understand the rudiments of Microfabrication techniques.
(iii) identify and understand the various sensors and actutators
(iv) different materials used for MEMS
(v) 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 – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching –
Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchant – 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.

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES:
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

EE2034  SOFTWARE FOR CIRCUIT SIMULATION
L T P C
3 0 0 3

UNIT  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  9
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  9
Introduction – Psipce overview – DC circuit Analysis –AC circuit analysis – Transient and the time
domain – Fourier Series and Harmonic components – An introduction to Psipce devices BJT, FET,
MOSFET and is model – Amplifiers and Oscillators – Nor linear Devices.

UNIT IV  MATLAB  9
Introduction - function description – Data types – Tool boxes – Graphical Display: Import and Export
of data – Programs for solution of state equations.

UNIT V  SIMULINK  9
Introduction – Graphical user Interface – Selection of objects – Blocks – lines Simulation -
Application programs.

TOTAL : 45 PERIODS

TEXT BOOKS
1. Rajagopalan.V ‘Computer aided analysis of power electronic systems’ Marcell
   Dekker 1987.

REFERENCES

EE2035  COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS  L T P C  3 0 0 3

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

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

UNIT I  INTRODUCTION  8
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  9

UNIT III PHILOSOPHY OF FEM

UNIT IV CAD PACKAGES

UNIT V DESIGN APPLICATIONS

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

EE2036 FLEXIBLE AC TRANSMISSION SYSTEMS

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

OBJECTIVES:

i. To understand the concept of flexible AC transmission and the associated problems.

ii. To review the static devices for series and shunt control.

iii. 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
UNIT II  STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS  9

UNIT III  THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS  9

UNIT IV  EMERGING FACTS CONTROLLERS  9

UNIT V  CO-ORDINATION OF FACTS CONTROLLERS  9
FACTs Controller interactions – SVC–SVC interaction - co-ordination of multiple controllers using linear control techniques – Quantitative treatment of control coordination.

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES: