COURSE STRUCTURE AND SYLLABUS
FOR
B.TECH. IN ELECTRICAL ENGINEERING
(Implemented from the Academic Year 2013-14 – for the new batch only)
### First Semester

**A. THEORY**

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*Industrial training to be conducted after 6th semester*
### Seventh Semester

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**B. PRACTICAL**

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**C. SESSIONAL**

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### Eighth Semester

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**B. PRACTICAL**

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List of Elective Subjects:

CS(EE)-501- Elective-I:
(a) Data structure & algorithm
(b) Computer Organization
(c) Micro Processor & Micro controller
(d) Computer Architecture

CS(EE)-601 - Elective-II:
(a) Software Engineering
(b) DBMS
(c) Object oriented programming
(d) Computer Network

EE-604-Elective-III:
(a) High voltage Engineering
(b) Illumination Engineering
(c) Energy management & audit
(d) Renewable & Non Conventional Energy

EE-702- Elective-IV:
(a) Power system-III
(b) Control system-III
(c) Electric Machine-III
(d) Advanced Power Electronics

EE-703-Elective- V:
(a) Power plant instrumentation & Control
(b) Sensors & Transducers
(c) Biomedical Instrumentation
(d) Process control

EC(EE)-701-Elective-VI:
(a) RF & Microwave Engg
(b) Digital Signal Processing
(c) Optical Communication & N/W
(d) Digital Communication

EE-802-Elective-VII:
(a) FACTs & HVDC transmission
(b) Power Plant Engineering
(c) Power Generation and Economics
(d) Power System Dynamics & Control
(e) AI & Soft Computing
(f) Advanced Electric Drives

EC(EE)-801- Elective-VIII:
(a) Digital Image Processing
(b) Communication Engg.
(c) VLSI & Microelectronics
(d) Embedded system
(e) Satellite Communication & Remote Sensing
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EE-801 - Elective-I: (a) Data Structure & Algorithm (b) Computer Organization (c) Micro Processor & Micro controller (d) Computer Architecture
CS(EE)-591-Elec-I: (a) Data Structure & Algorithm Lab (b) Computer Organization Lab (c) μ-Processor & μ-Controller Lab (d) Computer Architecture Lab
CS(EE)-601 - Elective-II: (a) Software Engineering (b) DBMS (c) Object oriented programming (d) Computer Network
EE-604-Elective-III: (a) High Voltage Engineering(b) Illumination Engineering (c) Energy Management & audit (d) Renewable and Non conventional Energy
CS(EE)-691 - Elective-II: (a) Software Engineering Lab (b) DBMS Lab (c) Object oriented programming Lab (d) Computer Network Lab
EE-702 - Elective-IV(a) Power system-III (b) Control system-III (c) Electric Machine-III (d) Advanced Power Electronics
EE-703-Elective- V: (a) Power plant Instrumentation & Control (b) Sensors & Transducers (c) Biomedical Instrumentation (d) Process control
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EC(EE)-791-Elective-VI: (a) RF & Microwave Engg. Lab(b) Digital Signal Processing Lab(c) Optical Communication & N/W/ Lab(d) Digital Communication Lab.
EE-802-Elective-VII: (a) FACTs & HVDC Transmission (b) Power Plant Engineering (c) Power Generation and economics (d) Power System Dynamics & Control (e) AI & Soft Computing (f) Advanced Electric Drives
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(e) Satellite Communication & Remote Sensing.

Jalpaiguri Government Engineering College, (An Autonomous Government College), B.Tech. (EE) Syllabus implemented from the Academic Year 2013-14 (for the new batch only)
Detailed Syllabus:

1st semester:
HU-101 English Language & Technical Communication 2-0-0-2-2:

Guidelines for Course Execution:

Objectives of the Course: This Course has been designed
1. To impart advanced skills of Technical Communication in English through Language Lab. Practice Sessions to 1st Semester UG students of Engineering & Technology.
2. To enable them to communicate confidently and competently in English Language in all spheres.

Desired Entry Behaviour:
The students must have basic command of English to Talk about day-to-day events and experiences of life. Comprehend Lectures delivered in English. Read and understand relevant materials written in English. Write grammatically correct English.

Strategies for Course Execution:
1. It is a Course that aims to develop Technical Communication Skills. It is, therefore, Lab-based and practical in orientation. Students should be involved in Practice Sessions.
2. The content topics should be conveyed through real-life situations. Lecture classes should be conducted as Lecture cum Tutorial classes.
3. Keeping in view the requirements of students, the teachers may have to prepare some learning aids task materials.
4. Some time should be spent in teaching stress and intonation.
5. In teaching ‘Speaking skill,’ emphasis should be on clarity, intelligibility, fluency, (as well as accepted pronunciation).
6. Micro Presentation and Group Discussion Sessions should be used for developing Communicative Competence.
7. The Language Lab, device should be used for giving audio-visual inputs to elicit students’ responses by way of Micro-Presentation, Pair Conversation, Group Talk and Class Discussion.
8. The teacher must function as a creative monitor in the Language Lab for the following:

A. Developing Listening Comprehension Skill:
1. Developing Listening Comprehension through Language Lab Device
2. Developing sub skills of the Listening Skill by Conversational Practice Sessions
3. Focusing on intelligent and advanced Listening Sessions e.g. Seminars, Paper Presentation, Mock Interviews etc.
4. Conducting Conversational Practice: Face to Face & Via Media (Telephone, Audio, Video + Clips)

B. Developing Speaking Competence:
a) Helping students in achieving clarity and fluency; manipulating paralinguistic features of speaking (voice modulation, pitch, tone stress, effective pauses)
Conducting Task oriented interpersonal, informal and semiformal Speaking / Classroom Presentation
b) Teaching strategies for Group Discussion
Teaching Cohesion and Coherence
Teaching effective communication & strategies for handling criticism and adverse remarks
Teaching strategies of Turn-taking, effective intervention, kinesics (use of body language) and courtesies and all components of softskills.

C. Developing Reading Comprehension Skill:
a) Developing Reading Skill through Non Technical (Literary) Texts (See Recommended Book 5)
1. The Thief by Ruskin Bond
2. The Open Window by Saki
3. Marriage is a private Affair by Chinua Achebe
4. The Moon in the Earthen Pot by Gopini Karunakar
b) Developing Reading Skill through Radio Commentary, Technical Texts and Case Studies (Refer to Recommended Book 1) Freedom by G. B. Shaw (Radio Commentary)
a) Guiding students for Intensive & Extensive Reading (See Recommended Book 1)

D. Developing Writing Competence:
a) Teaching all varieties of Technical Report, Business Letters and Job Application (Expressing Ideas within restricted word limit through paragraph division, Listing Reference Materials through Charts, Graphs, Tables and Diagrams);
b) Teaching correct Punctuation & Spelling, Semantics of Connectives, Modifiers and Modals, variety of sentences and paragraphs
c) Teaching Organizational Communication: Memo, Notice, Circular, Agenda / Minutes etc.

**SYLLABUS -- DETAILED OUTLINES**

**A. ENGLISH LANGUAGE GRAMMAR: 5L**
Correction of Errors in Sentences, Building Vocabulary, Word formation, Single Word for a group of Words, Fill in the blanks using correct Words, Sentence Structures and Transformation, Active & Passive Voice, Direct & Indirect Narration, (MCQ Practice during classes)

**B. READING COMPREHENSION:**
Strategies for Reading Comprehension 1L
Practicing Technical & Non Technical Texts for Global/Local/Inferential/Referential comprehension; 3L
Precis Writing

**C. TECHNICAL COMMUNICATION**
The Theory of Communication – Definition & Scope, Barriers of Communication, Different Communication Models, Effective Communication (Verbal / Non verbal), Presentation / Public Speaking Skills 5L (MCQ Practice during classes)

**D. MASTERING TECHNICAL COMMUNICATION**
Technical Report (formal drafting) 3L
Business Letter (formal drafting) 4L
Job Application (formal drafting) 3L
Organizational Communication (see page 3) 3L
Group Discussion – Principle & Practice 3L

Total Lectures 30

**MARKS SCHEME (Written Examination) Total Marks 70**
1. 10 Multiple Choice Questions (Communication & Eng. Language-Vocabulary & Syntax) Marks 10
2. Short Questions & Precis writing on unseen passages Marks 15 (10+5)
3. 3 Essay type Questions on Technical Communication (Technical Report / Business Letter / Job Application / Organizational Communication etc.) Marks 45-15*3

**MARKS SCHEME (Internal Examination) Total Marks 30**
1. Attendance Marks 5
2. Testing Speaking Ability Marks 5
3. Testing Listening Ability Marks 5
4. 2 Unit Tests Marks 15

**HU -181   English Language & Technical Communication Lab 0-0-3-3-2:**
a) Honing ‘Listening Skill’ and its sub skills through Language Lab Audio device; 3P
b) Honing ‘Speaking Skill’ and its sub skills; 2P
c) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/Voice modulation/ Stress / Intonation/ Pitch & Accent) of connected speech; 2P
j) Honing ‘Conversation Skill’ using Language Lab Audio – Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode); 2P
k) Introducing ‘Group Discussion’ through audio – Visual input and acquainting them with key strategies for success; 2P
f) G D Practice Sessions for helping them internalize basic Principles (turn-taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD; 4P
g) Honing ‘Reading Skills’ and its sub skills using Visual / Graphics/Diagrams /Chart Display / Technical/Non Technical Passages; Learning Global / Contextual / Inferential Comprehension; 2P
h) Honing ‘Writing Skill’ and its sub skills by using Language Lab Audio – Visual input; Practice Sessions 2P

Total Practical Classes 17

**Books Recommended:**
Dr. D. Sudharani: Manual for English Language Laboratory Pearson Education (WB edition), 2010
Board of Editors: Contemporary Communicative English for Technical Communication Pearson Longman, 2010
1.1 Simple Harmonic motion: Preliminary concepts, Superposition of Simple Harmonic motions in two mutually perpendicular directions: Lissajous figure.
1.2 Damped vibration: Differential equation and its solution, Logarithmic decrement, Quality Factor.
1.3 Forced vibration: Differential equation and its solution, Amplitude and velocity resonance, Sharpness of resonance. Application in L-C-R circuit.

Module 2: Optics I:
2.1 Interference of electromagnetic waves: Condition for sustained interference, double slit as an example. Qualitative idea of Spatial and Temporal Coherence, conservation of energy and intensity distribution, Newton’s ring.
2.2 Diffraction of light: Fresnel and Fraunhoffer class. Fraunhoffer diffraction for single slit and double slit. Intensity distribution of N-slits and plane diffraction grating (No deduction of the intensity distributions for N-slit), Missing orders. Rayleigh criterion, resolving power of grating and microscope.

Module 3: Optics II
3.3 Holography: Theory of holography, viewing of hologram, applications.

Module 4: Quantum Physics:
4.1 Concept of dependence of mass with velocity, mass energy equivalence, energy-momentum relation (no deduction required), Blackbody radiation: Rayleigh Jean’s law (derivation without the calculation of number of states), Ultraviolet catastrophe, Wien’s law, Planck’s radiation law (calculation of average energy of the oscillator), Derivation of Wein’s law and Stephan’s law from Planck’s radiation law. Rayleigh Jean’s law and Wien’s law as limiting case of Planck’s law. Compton’s effect (calculation of Compton wavelength is required).
4.2 Wave-particle duality and de Broglie’s hypothesis. Concept of matter waves, Davission-Germer experiment, Concept of wave packets and Heisenberg’s uncertainty principle.

Module 5: Crystallography:
5.1 Elementary ideas of crystal structure: Lattice, Basis, Unit cell, fundamental types of lattice-Bravais Lattice, simple cubic, FCC and BCC lattices (use of models in class during teaching is desirable), Miller indices and Miller planes, coordination number and atomic packing factor.
5.2 X-rays: origin of characteristic and continuous x-rays, Bragg’s law (no derivation), determination of lattice constant.
Innovative experiment:
One more experiment designed by the student or the concerned teacher or both.

**CS- 101  Introduction to Computer Programming  3-1-0-4-4:**

**Fundamentals of Computer:**
- History of Computer, Generation of Computer, Classification of Computers 2L
- Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output Devices 3L
- Binary & Allied number systems representation of signed and unsigned numbers. BCD, ASII. Binary Arithmetic & logic gates 6L
- Assembly language, high level language, compiler and assembler (basic concepts) 2L
- Basic concepts of operating systems like MS DOS, MS WINDOW, UNIX, Algorithm & flow chart 2L

**C Fundamentals:**
- The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements 3L

**Operators & Expressions:**
- Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Input and Output: Standard input and output, formatted output -- printf, formatted input scanf. 5L

**Flow of Control:**
- Statement and blocks, if - else, switch, loops - while, for do while, break and continue, go to and labels 2L

**Fundamentals and Program Structures:**
- Basic of functions, function types, functions returning values, functions not returning values, auto, external, static and register variables, scope rules, recursion, function prototypes, C preprocessor, command line arguments. 6L

**Arrays and Pointers:**
- One dimensional arrays, pointers and functions, multidimensional arrays. 6L

**Structures Union and Files:**
- Basic of structures, structures and functions, arrays of structures, bit fields, formatted and unformatted files. 5L

**Recommended reference Books:**
- Introduction To Computing (TMH WBUT Series), E. Balagurusamy, TMH
- Kernighan, B.W. The Elements of Programming Style
- Yourdon, E. Techniques of Program Structures and Design
- Schied F.S. Theory and Problems of Computers and Programming
- Gottfried Programming with C Schaum
- Kernighan B.W. & Ritchie D.M. The C Programming Language
- Rajaraman V. Fundamental of Computers
- Balaguruswamy Programming in C
- Kanetkar Y. Let us C
- M.M.Oka Computer Fundamentals, EPH
- Leon Introduction to Computers, Vikas
- Leon- Fundamental of Information Technology, Vikas
- Ram B. Computer Fundamentals, New Age International
- Ravichandran D. Programming in C, New Age International
- Xavier C. C Language & Numerical Methods, New Age Inter.
- Xavier C. Introduction to Computers, New Age International
- Rao S.B. Numerical Methods with Programs in Basic Fortran Pascal & C++,
- Dutta N. Computer Programming & Numerical Analysis, Universities Press
- Bhanu Pratap Computer Fundamentals
- Rajaram Computer Concepts & C Program, Scitech

**CS-191 Principles of Computer Programming Lab  0-0-3-3-2:**

Exercises should include but not limited to:
1. DOS System commands and Editors (Preliminaries)
2. UNIX system commands and vi (Preliminaries)
3. Simple Programs: simple and compound interest. To check whether a given number is a palindrome or not, evaluate summation series, factorials of a number, generate Pascal’s triangle, find roots of a quadratic equation.
4. Programs to demonstrate control structure: text processing, use of break and continue, etc.
5. Programs involving functions and recursion
6. Programs involving the use of arrays with subscripts and pointers
7. Programs using structures and files.

M-101 Mathematics-I 3-1-0-4-4:

Module I

Module II
Successive differentiation: Higher order derivatives of a function of single variable, Leibnitz’s theorem (statement only and its application, Problems of the type of recurrence relations in derivatives of different orders and also to find \((y_n)\).

Mean Value Theorems & Expansion of Functions: Rolle’s theorem and its application, Mean Value theorems – Lagrange & Cauchy and their application, Taylor’s theorem with Lagrange’s and Cauchy’s form of remainders and its application, Expansions of functions by Taylor’s and MacLaurin’s theorem, MacLaurin’s infinite series expansion of the functions: \(\sin x, \cos x, e^x, \log(1 + x), (a + x)^n\), \(n\) being an integer or a fraction.

Reduction formula: Reduction formulae both for indefinite and definite integrals of types
\[
\int \sin^m x \cos^n x \, dx, \quad \int \sin^m x \cos^n x \, dx, \quad \int \cos^m x \sin^n x \, dx, \quad \int \frac{dx}{(x^2 + a^2)^n}
\]
where \(m\), \(n\) are positive integers.

Module III
Calculus of Functions of Several Variables: Introduction to functions of several variables with examples, Knowledge of limit and continuity, Partial derivatives and related problems, Homogeneous functions and Euler’s theorem and related problems up to three variables, Chain rules, Differentiation of implicit functions, Total differentials and their related problems, Jacobians up to three variables and related problems, Maxima, minima and saddle points of functions and related problems, Concept of line integrals, Double and triple integrals.

Module IV
Infinite Series: Preliminary ideas of sequence, Infinite series and their convergence/divergence, Infinite series of positive terms, Tests for convergence: Comparison test, Cauchy’s Root test, D’ Alembert’s Ratio test and Raabe’s test (statements and related problems on these tests), Alternating series, Leibnitz’s Test (statement, definition) illustrated by simple example, Absolute convergence and Conditional convergence.

Module-V
Vector Algebra and Vector Calculus: Scalar and vector fields – definition and terminologies, dot and cross products, scalar and vector triple products and related problems, Equation of straight line, plane and sphere, Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative. Related problems on these topics, Green’s theorem, Gauss Divergence Theorem and Stoke’s theorem (Statements and applications).

Total 40 Lectures

Suggested Reference Books
1. Advanced Engineering Mathematics 8e by Erwin Kreyszig is published by Wiley India
2. Engineering Mathematics: B.S. Grewal
8. Differential Calculus, Ghosh & Maity (Central)
9. **Integral Calculus**, Ghosh & Maity (Central)
11. **Vector Analysis (Schaum Series)**, M. R. Spiegel (MGH)

**ME-101 Engineering Mechanics 3-1-0-4-4:**

**Module – I**
Importance of mechanics in Engg.; Introduction to Statics; Concept of particle and Rigid Body; Types of Forces: 2L
Introduction to Vector Algebra; Parallelogram Law; Triangle and Polygon Law; Addition and Subtraction of Vector; Dot product and Cross product of Vectors; Unit Vector; Dot product and Cross product of Vectors and their applications. Types of Vectors ( Sliding Vector, Bound Vector ). 4L+1T
Two dimensional force system, Resolution of forces; Moments; Varignon’s theorem; Couple; Equivalence of Force and Force – Couple system. 4L+2T

**Module – II**
Equilibrium of a body under two dimensional force system and under two dimensional force-moment system; Free body diagram; Lami’s Theorem. 3L+1T
Friction; Co-efficient of friction; Laws of friction; Angle of Repose; Wedge friction. 3L+1T

**Module – III**
Centroid and Centre of Gravity; Centroid of Triangle, Quadrant of a circle and rectangle; Centroid of a composite area. 3L+1T
Moment of Inertia of a plane figure about Co-planer axes; Parallel axis theorem; Polar Moment of Inertia; Mass Moment of Inertia of cylinder, sphere and cone about the axis of symmetry. 3L+1T

**Module – IV**
Introduction to Dynamics; Kinematics and Kinetics; Newton’s Laws of motion; Plane rectilinear motion under uniform and non-uniform acceleration; 3L+1T
x-t, v-t and a-t graphs; Motion under gravity; Plane Curvilinear motion; Circular motion; Projectile motion. 3L+1T

**Module – V**
Kinetics of particles; Newton’s second Law; D’ Alembert’s principle; Principle of work, Energy and power; Principle of conservation of energy. 3L+1T

**Module – VI**
Concept of stresses and strains; Normal stress; Shear stress; Normal strain; Shear strain; Hooke’s Law; Poisson’s ratio; Stress-strain diagram of ductile material and brittle material; Elastic Modulus and Shear Modulus; Factor of safety-basic idea; bulk Modulus; Volumetric strain.

**Books Recommended:**
1. Engineering mechanics : Statics and dynamics by I.H. Shames, 4th ed. – PHI.
2. Engineering mechanics by Timoshenko, Young and Rao, Revised 4th ed. – TMH.
3. Elements of Strength of Materials by Timoshenko & Young, 5th ed. – E.W.P.

**ME-191 Engineering Drawing &Graphics Lab. 0-0-3-3-2:**

**A. THEORETICAL PART**
1. Introduction to Lines, Lettering, Dimensioning, Scales. – 1L
2. Geometrical Construction and curves. – 1L
3. Projection of points, Lines and Surfaces. – 2L
4. Projection of solids. – 2L
5. Isometric Views. – 1L
6. Sectional Views. – 1L
7. Development of Surfaces. – 1L
8. Introduction to Computer Aided Drafting. – 3L

**B. PRACTICAL PART**
1. LINES, LETTERING, DIMENSIONING, SCALES: Plain scale, Diagonal scale. - 6hrs.
2. GEOMETRICAL CONSTRUCTION AND CURVES: Construction of Polygons, Parabola, Hyperbola, Ellipse. - 6 hrs.
3. PROJECTION OF POINTS, LINES, SURFACES: Orthographic projection – 1st and 3rd angle projection, Projection of lines and surfaces – Hexagon. - 3 hrs.
4. PROJECTION OF SOLIDS: Cube, Pyramid, prism, Cylinder, Cone. - 6 hrs.
5. DRAWING ISO-METRIC VIEW FROM ORTHOGRAPHIC / SECTIONAL VIEWS OF SIMPLE SOLID OBJECTS. - 3 hrs.
6. FULL AND HALF SECTIONAL VIEWS OF SOLIDS. - 3 hrs.
7. DEVELOPMENT OF SURFACES: Prism, Cylinder, Cone. - 3 hrs.

Books Recommended:

XC -181 Extra Curricular Activities (NSS/NSO/NSO ETC) ( 0-0-2-2-1:

a) Creating awareness in social issues
b) Participating in mass education programmes
c) Proposal for local slum area development
d) Waste disposal
e) Environmental awareness
f) Production Oriented Programmes
g) Relief & Rehabilitation work during Natural calamities

Creating awareness in social issues:
1. Women’s development – includes health, income-generation, rights awareness.
2. Hospital activities – Eg. writing letters for patients, guiding visitors
3. Old age home – visiting the aging in-mates, arranging for their entertainment.
4. Children’s Homes - visiting the young in-mates, arranging for their entertainment
5. Linking with NGOs to work on other social issues. (Eg. Children of sex-workers)
6. Gender issues- Developing an awareness, to link it with Women’s Cell of college
Participating in mass education programmes
1. Adult education
2. Children’s education
Proposal for local slum area development
One or two slums to be identified and according to the needs, activities to be developed and proposals and reports are to be submitted.

Environmental awareness
- Resource conservation – Awareness to be developed on water, energy, soil.
- Preservation of heritage monuments- Marches, poster campaigns
- Alternative energy consciousness amongst younger school-children.
- Plantation and beautification- Plantation of trees, their preservation and upkeep, developing NSSparks.
- Waste disposal- Proper methods of domestic waste disposal.

Production Oriented Programmes
5. Working with people and explaining and teaching improved agricultural practices
6. Rodent control land pest control practices;
7. Soil-testing, soil health care and soil conservation;
8. Assistance in repair of agriculture machinery;
9. Work for the promotion and strengthening of cooperative societies in villages;
10. Assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
11. Popularization of small savings and
12. Assistance in procuring bank loans
Relief & Rehabilitation work during Natural calamities
  g) Assisting the authorities in distribution of rations, medicine, clothes etc.;
  h) Assisting the health authorities in inoculation and immunization, supply of medicine etc.;
  i) Working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
  j) Assisting and working with local authorities in relief and rescue operation; Collection of clothes and other materials, and sending the same to the affected areas;

2nd semester:

HU-202 Economics for Engineers  3-0-3-3:


2. **Cost Accounting**: Introduction, Classification of Costs; Break-even Analysis; Budgeting & Budgetary Control, Objectives, Advantages & Limitations of Budgeting, Cash Budget, Flexible Budget, Master Budget, etc


4. **Economics**

References
1. Modern Accountancy A. Mukherjee & M. Hanif Tata McGraw- Hill
2. Accountancy (Vol.1) Dr. S.K. Paul New Central Book Agency
3. Practice in Accountancy S. P. Basu & Monilal Das Rabindra Library
4. Modern Economic Theory K.K. Dewett S.Chand
6. Economics for Business John Sloman & Mark Sutdiffe Pearson Education
8. Financial Management Dr. S. Kr. Paul New Central Book Agency

EE-201: Basic Electrical Engineering  3-1-0-4-4

**Introduction**: Overview of Source of energy, Generation, Transmission and Distribution of Electric Power.


**Single-phase AC Network**: Single-phase AC Circuits, Generation of Sinusoidal Voltage Waveform (AC) and Some Fundamental Concepts, Representation of Sinusoidal Signal by a Phasor, Current and Resonance in R-L-C Series and parallel Circuits.


**Magnetic Circuits**: Magnetic circuits, Core losses, Eddy Current & Hysteresis Loss.
Transformer: Ideal & Practical Transformer, Testing, Efficiency & Regulation, Three Phase Transformer, Auto-Transformer, Problem solving on Transformers


General structure of electrical power system: Power generation to distribution through overhead lines and underground cables with single lone diagram.

Text books:
4. Basic Electrical Engineering, J.P. Tewari, New age international publication

Reference books:
1. Basic Electrical Engineering(TMH WBUT Series), Abhijit Chakrabarti & Sudipta Nath, TMH
3. Hughes Electrical & Electronics Technology, 8/e, Hughes, Pearson Education.
5. Introduction to Electrical Engineering, M.S. Naidu & S, Kamakshaiah, TMH

EE-291: Basic Electrical Engineering Lab. 0-0-3-3-2
List of Experiments:
1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. (a) Verification of Thevenin’s theorem.
   (b) Verification of Norton’s theorems.
4. Verification of Maximum power theorem.
5. Verification of Superposition theorem
6. Study of R-L-C Series circuit
7. Study of R-L-C parallel circuit
8. Calibration of ammeter and voltmeter.
10. No load characteristics of D.C shunt Generators
11. Starting and reversing of speed of a D.C. shunt
12. Speed control of DC shunt motor.
13. Measurement of power in a three phase circuit by two wattmeter method

CH-201 Chemistry-I: 3-1-0-4-4:
Module 1: Chemical Thermodynamics
Concept of Thermodynamic system: Definition with example of diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property.

Introduction to first law of thermodynamics: Different statements, mathematical form.

Internal energy: Definition, example, characteristics, physical significance, mathematical expression for change in internal energy, expression for change in internal energy for ideal gas.

Enthalpy: Definition, characteristics, physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas.

**Reversible and irreversible processes:** Definition, work done in isothermal reversible and isothermal irreversible process for ideal gas, adiabatic changes: Work done in adiabatic process, interrelation between thermodynamic parameters (P, V, and T), slope of $P-V$ curve in adiabatic and isothermal process.

**Application of first law of thermodynamics to chemical processes:** exothermic, endothermic processes, law of Lavoisier and Laplace, Hess’s law of constant heat summation, Kirchhoff’s law. **3L**

**2nd law of thermodynamics:** Statement, mathematical form of 2nd law of thermodynamics (Carnot cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for ideal gas, concept of inversion temperature. Evaluation of entropy: Characteristics and expression, entropy change in irreversible cyclic process, entropy change for irreversible isothermal expansion of an ideal gas, entropy change of a mixture of gases. **2L**

Work function and free energy: Definition, characteristics, physical significance, mathematical expression of $\Delta A$ and $\Delta G$ for ideal gas, Maxwell’s Expression (only the derivation of four different forms), Gibbs Helmholtz equation, condition of spontaneity and equilibrium reaction. **5L**

**Module 2: Industrial Chemistry and Polymerization**

**Industrial chemistry**

**Solid Fuel:** Coal, classification of coal, constituents of coal, carbonization of coal (HTC and LTC), coal analysis: Proximate and ultimate analysis.

**Liquid fuel:** Petroleum, classification of petroleum, refining, petroleum distillation, thermal cracking, octane number, cetane number, aviation fuel (aviation gasoline, jet gasoline), and bio-diesel.

**Gaseous fuels:** Natural gas, water gas, coal gas, bio-gas. **5L**

**Polymerization**

Concepts, classifications and industrial applications

Polymer molecular weight (number avg. weight avg. viscosity avg.: Theory and mathematical expression only), Poly dispersity index (PDI).

Polymerization processes (addition and condensation polymerization), degree of polymerization, copolymerization.

Preparation, structure and use of some common polymers: plastic (PE: HDPE, LDPE), rubber (natural rubber, SBR), fibre (nylon 6.6). Vulcanization, conducting and semi-conducting polymers. **3L**

**Module 3: Reaction dynamics, and structure and reactivity of organic molecules**

**Reaction dynamics:** Reaction laws: rate and order; molecularity; zero, first and second order kinetics.

Pseudomolecular reaction, Arrhenius equation. Mechanism and theories of reaction rates (Transition state theory, Collision theory). Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics). **3L**

**Structure and reactivity of Organic molecules**

Electronegativity, electron affinity, hybridisation, Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals. Brief studies on some addition, elimination, and substitution reactions. **3L**

**Module 4: Electrochemistry**

**Conductance:** Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (strong and weak electrolyte). Kohlrausch’s law of independent migration of ions, transport numbers, and hydration of ions.

Conductometric titrations: SA vs SB & SA vs WB; precipitation titration KCl vs AgNO₃. **2L**

**Electrochemical cell:** Cell EMF and its thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half cell, quinhydrone half cell and calomel half cell (construction, representation, cell reaction, expression of potential, discussion, application).

Storage cell, fuel cell (construction, representation, cell reaction, expression of potential, discussion, application). Application of EMF measurement on (a) ascertain the change in thermodynamic function ($\Delta G$, $\Delta H$, $\Delta S$) (b) ascertain the equilibrium constant of a reversible chemical reaction (c) ascertain the valency of an ion. **3L**

**Module 5: Solid state and coordination chemistry**

**Solid state Chemistry**

Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency). Role of silicon and germanium in the field of semiconductor. **2L**

**Coordination chemistry:**

Double salt, complex salt. Werner’s theory of coordination compounds, coordination number, ligand, chelate, stability constant: stepwise and overall. **2L**

**Reference Books**
2. S. Glasstone, Text Book of Physical Chemistry, Macmillan India Limited.
6. F.W. Billmeyer: Textbook of Polymer Science is published by Wiley India (is now an Indian print).
11. Inorganic Chemistry—R. L. Dutta, Current Distributors

CH-291 Chemistry-I Lab. 0-0-3-3-2:

List of Experiments

1. To Determine the alkalinity in a given water sample.
2. Redox titration (estimation of iron using permanganometry)
3. To determine calcium and magnesium hardness of a given water sample separately.
4. Estimation of available chlorine in bleaching powder.
5. To determine chloride ion in a given water sample by argentometric method (using chromate indicator solution).
6. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water)
7. Viscosity of solutions (determination of percentage composition of sugar solution from viscosity)
8. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
9. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
10. Determination of dissolved oxygen present in a given water sample.
11. Estimation of available oxygen in pyrolusite.

M-201 Mathematics-II 3-1-0-4-4:

Module I

Ordinary differential equations (ODE)- First order and first degree: Exact equations, Necessary and sufficient condition of exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear equation, Bernoulli’s equation. General solution of ODE of first order and higher degree (different forms with special reference to Clairaut’s equation). 6L

Module II

ODE- Higher order and first degree: General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Cauchy-Euler equations, Solution of simultaneous linear differential equations. 7L

Module III

Partial Differential Equations: Origin of PDE, its order and degree, concept of solution in PDE. Solution of First Order Partial differential equation by Lagrange’s Method, Integral Surfaces passing through a given curve, Solution of non-linear first order partial differential equations by Charpit’s method, Solution of Second order Linear partial Differential equations with constant coefficients and with variable coefficients. 14L

Module IV

Improper Integral: Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations. 3L

Laplace Transform (LT): Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property; LT of \( \frac{f(t)}{t} \), \( t^n f(t), f^{(n)}(t) \) and \( \int f(t) \, dt \). Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties; Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT. 10L

Total 40 Lectures

Suggested Reference Books:
2. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)
5. An Introduction to Differential Equations, R.K. Ghosh and K.C.Maity (New Central Book Agency)
7. Laplace Transforms, M. R. Spiegel(MGH)

EC-201 Basic Electronics Engineering  3-1-0-4-4:
Pre-requisite: Knowledge of class XII level Physics and Mathematics

Introduction: Basic ideas on different circuit components (Resistor,Inductor,Capacitor)  1L
Module – 1: Semiconductors: 4L
Crystalline material: Mechanical properties, Conductors, Semiconductors and Insulators: electrical properties. Energy band theory, Fermi levels; Semiconductors: intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers.

Module – 2: Diodes and Diode Circuits: 3L+3L = 6L
Formation of P-N junction, energy band diagram, built-in-potential, forward and reverse biased P-N junction, formation of depletion region, Junction capacitance, V-I characteristics of diode, Simple diode circuits, load line, linear piecewise model; Rectifier circuits: half wave, full wave, (PIV, DC voltage and current, ripple factor, efficiency), idea of regulation, rectifier filter circuits, clipper, clamper, voltage multiplier circuits, breakdown mechanism of diodes, Zener diode,Vaactor diode.

Module – 3: Bipolar Junction Transistors: 5L+2L=7L
Formation of PNP / NPN junctions, energy band diagram; current flow diagram, transistor mechanism and transistor principles, CE, CB, CC configuration, transistor input output characteristics: amplification factors for CB,CC and CE modes. Biasing and Bias stability: calculation of stability factor; small signal analysis, h-parameter model.

Module – 4: Field Effect Transistors: 5L
Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD amplifier configurations, FET parameters, small signal equivalent circuits for different configurations; CMOS: Basic Principles.

Module – 5: Feed Back Amplifier and Operational Amplifiers: 4L+4L = 8L
Positive and negative feed back, close loop gain, open loop gain, topologies of feed back amplifier,:output impedance, input impedance, sensitivities (qualitative), bandwidth stability; effect of positive feed back: instability and oscillation, condition of oscillation, Barkhausen criteria. Introduction to integrated circuits, open loop characteristics of operational amplifier; Application of operational amplifier; inverting and non-inverting mode of operation, Adders, Subtractors, Constant gain multiplier, Voltage follower, Comparator, Integrator, Differentiator. OPAMP parameters: CMRR, OFFSET parameters, slew rate.

Module – 6: Special Semiconductor devices: 3L
SCR, DIAC, TRIAC, UJT, IGBT- structure, characterization, principle of operation and applications.

Module – 7: Cathode Ray Oscilloscope (CRO): 4L
CRT structure, block diagram, operation, Deflection systems, sweep circuit operation, basic block of CRO, applications of CRO, Frequency,phase and amplitude measurement using CRO, Lissajous figure.

Module – 8: Digital Electronics: 2L
Introduction to binary number; Basic Boolean algebra, De Morgan’s Theorem, Logic gates.

Outcome: The students will be able to select proper electronics component and device depending on the requirement. The student should be able to use required rectifier circuit and to calculate it’s different parameters. The students must be able to design a transistor amplifier.

Recommended Books:

Text.
1. Chattopadhyay & Rakshit: Electronics Fundamentals & Applications
2. Millman & Halkias: Integrated Electronics References:
2. Sanjeev Gupta: Electronics Devices Circuits
EC-291 Basic Electronics Engineering Lab. 0-0-3-3-2:
There will be a couple of familiarization lectures before the practical classes are undertaken where basic concept of the instruments handled Eg: CRO, Multimeters etc will be given.

List of Experiments:
1. Familiarisation with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multimeters etc.
2. Familiarisation with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.
7. Study of Characteristic curves for CB, CE and CC mode transistors
8. Study of I-V characteristics of Field Effect Transistors.
9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.

ME-292 Workshop Practice 0-0-3-3-2:
Jobs:

![Diagram](image1)

**Fig.1:** Job for fitting practice

![Diagram](image2)

**Fig.2:** Job for practice on a lathe

½ x 12 TP1 (BSW) or φ 10 x 2 MM (metric)
1. FITTING: Making a gauge from MS plate as shown in Fig.1.

Operations required:
   a. Squaring and finishing of the blank by filing
   b. Making the Vee-portion by sawing and filing
   c. Drilling (in machine) and tapping (hand)

2. MACHINING: To make a pin as shown in Fig.2 from a \( \phi 20 \) mm mild steel rod in a lathe.

3. MACHINING: To make a MS prism as shown in Fig.3 from a \( \phi 20 \) mm mild steel rod in a shaping and/or milling machine.

4. PATTERN MAKING, SAND MOULDING AND CASTING: To make a wooden pattern and a sand mould with that pattern for casting a cast iron block as shown in Fig.4.

5. WELDING (GAS WELDING): To join two thin mild steel plates or sheets (1 to 3 mm thick) as shown in Fig.5 by gas welding.

6. WELDING (ARC WELDING): To join two thick (6 mm) MS plate as shown in Fig.5 by arc welding.
7. SHEET METAL WORK (in 1 day or 3 hours); Forming a cone, for example.

3rd semester:

**HU-301 VALUES & ETHICS IN PROFESSION  3-0-0-3-3:**
Science, Technology and Engineering as knowledge and as Social and Professional Activities.
Effects of Technological Growth: Rapid Technological growth and depletion of resources, Reports of the Club of Rome.
Limits of growth: sustainable development
Environmental Regulations, Environmental Ethics,
Appropriate Technology Movement of Schumacher; later developments Technology and developing notions. Problems of
Technology transfer, Technology assessment impact analysis.
Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line
and automation. Human centered Technology.
Ethics of Profession: Engineering profession: Ethical issues in Engineering practice, Conflicts between business
and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing
and beyond, Case studies.
Profession and Human Values: Values Crisis in contemporary society
Nature of values: Value Spectrum of a good life
Psychological values: Integrated personality; mental health
Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian
Constitution.
Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity
Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of
responsibility.
Books:
   (2nd Ed)

**PH(EE)-301 Physics-II  3-1-0-4-4:**
Quantum mechanics:
• Generalized co-ordinates, Lagrange’s equation of motion and Lagrangian, generalized force potential, moment and
• Concept of probability and probability density, operator, Commutator, Formulation of quantum mechanics and Basic
postulates, Operator correspondence, Time dependent Schrödinger’s equation, formulation of time independent
Schrödinger’s equation by method of separation of variables, Physical interpretation of wave function Ψ(normalization
and probability interpretation), Expectation values, Application of Schrödinger equation-Particle in an infinite squarewell
potential (1-D and 3-D potential well), Discussion on degenerate levels.
Statistical mechanics:
• Concept of energy levels and energy states. Microstates, Macrostates and thermodynamic probability, equilibrium
macrostate. MB, FD, BE statistics (no deduction necessary), fermions, bosons (definitions in terms of spin, examples),
physical significance and application, classical limits of quantum statistics. Fermi distribution at zero and non –
zerotemperature.
Dielectric Properties:
• Dielectric Material: Concept of Polarization, the relation between D, E and P, Polarizability, Electronic, Ionic,
Orientation & Space charge polarization, behavior of Dielectric under alternating field, Dielectric losses.
The Magnetic properties:
• Magnetization M, relation between B, H & M. Bohr megneton, Diamagnetism-Larmor frequency & susceptibility,
Curie law, Weiss molecular field theory & Curie-Weiss law, Hysteresis loss, Antiferromagnetism, Ferromagnetism&
Ferrites (analitative).
Crystal structure:
• Crystal structure- Bravais lattice, Miller indices
• Crystal diffraction (qualitative), Bragg's law and reciprocal lattice, Brillouin zone. (Qualitative description)
• Free electron theory of metal – calculation of Fermi energy, density of states.
• Band theory of solids- Bloch theorem, Kronig Penny model.
• Electronic conduction in solids-Drude’s theory, Boltzmann equation, Wiedemann Frantz law.
• Semiconductor-Band structure, concept of electron and holes, Fermi level, density of states.
Superconductivity: BCS theory (qualitative), operation of cryotron, Meissner effect.

Text Books:
1. Perspectives of Modern Physics: A. Baiser
2. Modern Physics and Quantum Mechanics E.E. Anderson
   b) R.G. Takwal & P.S. Puranic
6. Quantum Mechanics: a) Eisberg & Resnic
   b) A.K. Ghatak & S. Lokanathan
   c) S.N. Ghosal
7. Statistical Mechanics and Thermal Physics: a) Sears and Salinger
   b) Avijit Lahiri
   c) Evelyn Guha
8. Solid State Physics: a) A.J. Dekker
   b) C. Kittel
   c) Ashcroft & Mermin
   d) S.O. Pillai

PH(EE)-391 Physics-II Lab. 0-0-3-3-2:
1. Determination of dielectric constant of a given dielectric material.
2. Determination of thermo electric power at a certain temperature of a given thermocouple.
3. Determination of specific charge (e/m) of electron by J.J. Thompson’s method.
4. Determination of Planck constant using photocell.
5. Determination of Landé’g factor using Electron spin resonance spectrometer.
6. Determination of Stefan’s radiation constant.
7. Verification of Bohr’s atomic orbital theory through Frank-Hertz experiment.
10. Determination of Band gap of semiconductor.
11. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

M-302 Mathematics-III 3-1-0-4-4:
Calculus of Complex Variable :Complex functions, Concept of Limit, Continuity and Differentiability. Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be


Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m. Examples on determination of singularities and their nature. Residue, Cauchy’s Residue theorem (statement only), problems on finding the residue of a given function, evaluation of definite integrals:

\[ \int_0^\infty \sin \frac{x}{x} \, dx, \int_0^{2\pi} \frac{d\theta}{a + b \cos \theta + c \sin \theta}, \int_C \frac{P(z)}{Q(z)} \, dz \]

(elementary cases, P(z) & Q(z) are polynomials of 2nd order or less).


**Partial Differential Equation (PDE):** Solution by Separation of variables and Integral Transform (Laplace & Fourier transform) methods: (i) One dimensional Wave equation (ii) One dimensional Heat equation, (iii) Two dimensional Laplace equation.

**Series solution of Ordinary Differential Equation (ODE):** Validity of the series solution of an ordinary differential equation. General method to solve \( a_0(x)y'' + a_1(x)y' + a_2(x)y = 0 \) and related problems. Series solution, Bessel function, recurrence relations of Bessel’s Function of first kind. Legendre’s equation: Series solution, Legendre function, recurrence relations and orthogonality relation.

**Text Books:**
2. Das N.G.: Statistical Methods, TMH.
5. Lipschutz S., and Lipson M.L.: Probability (Schaum's Outline Series), TMH.

**References:**
7. Sneddon, I. N.: Use of Integral Transforms, MGH
8. Bhatia, R, Fourier Series, MAA

**ME(EE)-301 Elements of Mechanical Engineering 3-0-0-3-3:**

Basic Concepts of Thermodynamics: Introduction, Microscopic and Macroscopic viewpoints
Definition of Thermodynamic systems: closed, open and isolated systems
Concept of Thermodynamics state; state postulate.
Definition of properties: intensive, extensive & specific properties, Thermodynamic equilibrium
Thermodynamic processes; quasi-static, reversible & irreversible processes; Thermodynamic cycles, Zeroth law of thermodynamics. Concept of empirical temperature. Heat and Work, Definition & units of thermodynamic work. Examples of different forms of thermodynamic works; example of electricity flow as work. Work done during expansion of a
compressible simplesystem, Definition of Heat; unit of Heat, Similarities & Dissimilarities between Heat & Work Ideal Equation of State, processes; Real Gas, Definition of Ideal Gas; Ideal Gas Equations of State. Thermodynamic Processes for Ideal Gas; P-V plots; work done, heat transferred for isothermal, isobaric, isochoric, isentropic & polytropic processes. Equations of State of Real Gases: Van der Waal’s equation; Virial equation of state. Properties of Pure Substances p-v & P-T diagrams of pure substance like H2O, Introduction to steam table with respect to steam generation process; definition of saturation, wet & superheated status. Definition of dryness fraction of steam, degree of superheat of steam.


2nd Law of Thermodynamics: Definition of Sink, Source Reservoir of Heat, Heat Engine, heat Pump & Refrigerator; Thermal efficiency of Heat Engines & co-efficient of performance of Refrigerators, Kelvin – Planck & Clausius statements of 2nd Law of Thermodynamics, Absolute or Thermodynamic scale of temperature, Clausius Integral. Entropy: Entropy change calculation for ideal gas processes. Carnot Cycle & Carnot efficiency, PMM-2; definition & its impossibility, Air standard Cycles for IC engines, Otto cycle; plot on P-V, T-S planes; Thermal efficiency, Diesel cycle; plot on P-V, T-S planes; Thermal efficiency, Rankine cycle of steam, h-s chart of steam (Mollier’s Chart), Simple Rankine cycle plot on P-V, T-S, h-s planes, Rankine cycle efficiency with & without pump work. (Problems are to solved for each module)

Properties & Classification of Fluids: Ideal & Real fluids, Newton’s law of viscosity; Newtonian and Non-Newtonian fluids, Compressible and Incompressible fluids,

Fluid Statics: Pressure at a point, Measurement of Fluid Pressure
Manometers: simple & differential, U-tube, Inclined tube, Fluid Kinematics, Stream line, laminar & turbulent flow, external & internal flow, Continuity equation, Dynamics of ideal fluids, Bernoulli’s equation, Total head; Velocity head; Pressure head; Application of Bernoulli’s equation
Measurement of Flow rate: Basic principles, Venturimeter, Pilot tube, Orifice meter.

Text:
1. Engineering Thermodynamics - P K Nag, 4th edn, TMH.
2. Fluid Mechanics and Hydraulic Machines - R K Bansal

References:
1. "Fundamentals of Thermodynamics" 6e by Sonntag & Van Wylin published by Wiley India.
2. Engineering Thermodynamics – Russel & Adeliyi (Indian edition), OUP
5. Introduction to Fluid Mechanics and Fluid Machines - S.K.Som and G.Biswas. 2nd edn, TMH

EC(EE)-301 Analog & Digital Electronic Circuit 3-0-0-3-3:
Filters & Regulators: Capacitor filters, π-section filter, ripple factor, series and shunt voltage regulator, percentage regulation, Concept of SMPS.
Trans-resistance & Trans-conductance, Emitter follower circuits, High frequency model of Transistor.
Oscillators: Hartley’s, Phase shift, Wien bridge, & Crystal oscillators.
Operational amplifier: Constant current source (Current mirror etc), Level shifter, CMRR, Voltage follower circuits.
Schmitt Trigger, Instrumentation Amplifier, Log & Antilog, amplifier, Trans-conductance multiplier, Precision rectifier, Voltage to current & Current to voltage converter.
Multivibrator: Monostable, Bistable multivibrator, Monostable & Astable operation using 555 timer.
Special function circuits: VCO & PLL
Data and number system: Binary, Octal and Hexadecimal representation and their conversion, BCD, ASCII, EBDIC, Gray codes and their conversion, Signed binary numbers representation with 1’s and 2’s complement methods, Binary arithmetic.
Memory systems: RAM, ROM, EPROM, EEROM 4
Basic memory elements, S-R, J-K, D, and T Flip flop, various types of Registers, Counters & their design, Irregular counter, State table & State transition diagram, Sequential circuit design methodology.

Different types of A/D and D/A conversion techniques.

Books:
1. Microelectronic Circuits, Sedra & Smith, Oxford University Press.
3. Electronic devices & Circuits, Balbir Kumar & ShailB. Jain, PHI.
4. Op-amps and Linear IC’s, R.A. Gayakwad, PHI.
8. Operational Amplifier & Linear IC’s, Bell, Oxford University Press.
14. Fundamental of Digital Circuits, A. Anand Kumar, PHI.
15. Digital Logic Design, Morries Mano, PHI.
18. Fundamental of logic Design, Charles H. Roth, Thomson Delman Learning

EC(EE)-391 Analog & Digital Electronic Circuit Lab. 0-0-3-3-2:
1. Study of Ripple and Regulation characteristics of full wave rectifier with and without capacitor filter.
2. Study of Zener diode as voltage regulator.
3. Construction of two stage R-C coupled amplifier & study of its gain and Bandwith.
5. Realisation V-I & I-V converter using Operational Amplifier.
7. Study of DAC & ADC
8. Realisation of basic gates using Universal logic gates.
10. Design of Combinational circuit for BCD to decimal conversion to drive 7-segment display using Multiplexer.

EE-301 Electric Circuit Theory 3-1-0-4-4
Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals.

Coupled circuits: Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, Solution of problems.


Fourier method of waveform analysis: Fourier series and Fourier Transform (in continuous domain only). Application in circuit analysis, Solution of Problems

Graph theory and Networks equations: Concept of Tree, Branch, Tree link, Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials. Duality, Solution of Problems

Two port networks analysis: Open circuit Impedance & Short circuit, Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems

Filter Circuits: Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems.

Text Books:
1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers

Reference Books:
1. Network Analysis, M.E. Valkenburg, Pearson Education

EE-391 Electric Circuit Theory Lab. 0-0-3-3-2
Transient response of R-L and R-C network: Simulation with PSPICE /Hardware
2. Transient response of R-L-C series and parallel circuit: Simulation with PSPICE /Hardware
3. Determination of Impedance (Z) and Admittance (Y) parameter of two port network: Simulation /Hardware.
5. Frequency response of BR and BR filters: Simulation /Hardware.
6. Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form.
7. Determination of Laplace transform and Inverse Laplace transform using MATLAB.
8. Amplitude and Phase spectrum analysis of different signals using MATLAB.
9. Verification of Network theorem using SPICE

HU-381 Technical Report Writing Practice 0-0-2-2-1:
Guidelines for Course Execution:
Objectives of this Course: This course has been designed:
1. To inculcate a sense of confidence in the students.
2. To help them become good communicators both socially and professionally.
3. To assist them to enhance their power of Technical Communication.

Detailed Course Outlines:
Technical Report Writing:
1. Report Types (Organizational / Commercial / Business / Project )
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)

Interview Sessions:
1) Training students to face Job Interviews confidently and successfully
2) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for effective communication

4. Presentation:
a) Teaching Presentation as a skill
b) Strategies and Standard Practices of Individual /Group Presentation
c) Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids

5. Competitive Examination:
   a) Making the students aware of Provincial /National/International Competitive Examinations
   b) Strategies/Tactics for success in Competitive Examinations
   c) SWOT Analysis and its Application in fixing Target

Books – Recommended:

4th semester:
M(CS)-401 NUMERICAL METHODS 3-0-0-3-3:
Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.
Interpolation: Newton forward/backward interpolation, Lagrange’s and Newton’s divided difference Interpolation.
Numerical integration: Trapezoidal rule, Simpson’s 1/3 rule, Expression for corresponding error terms.

Text Books:

References:
2. Baburam: Numerical Methods, Pearson Education.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

M(CS)-491 NUMERICAL METHODS 0-0-3-3-2:
1. Assignments on Newton forward/ backward, Lagrange’s interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson’s 1/3 rule, Weddle’s rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Euler’s and Runga-Kutta methods.
6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

EE-403  Field Theory  3-1-0-4-4
Introduction: Co-ordinate systems and transformation, Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems. Solution of problems
Electrostatic field: Coulomb’s law, field intensity, Gauss’s law, Electric potential and Potential gradient, Relation between E and V, an Electric dipole and flux lines. Energy density in electrostatic field.
Boundary conditions: Dielectric-dielectric, Conductor–dielectric, Conductor-free space.
Poisson’s and Laplace’s equation, General procedure for solving Poisson’s and Laplace’s equation. Solution of problems

**Magneto static fields:** Biot- savart law, Ampere’s circuit law, Magnetic flux density, Magnetic static and Vector potential, Forces due to magnetic field, Magnetic torque and moments, Magnetisation in material, Magnetic boundary condition, Inductor and Inductances, Magnetic energy, Force on magnetic material. Solution of problems

**Electromagnetic fields:** Faraday’s law, Transformer and motional emf, Displacement current, Maxwell’s equations, Time varying Potential, Time harmonic fields. Solution of problems

**Electromagnetic wave propagation:** Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarisation. Solution of problems.

**Transmission line:** Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems

**Text Books:**

**Reference Books:**

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**ME(EE)-401: Thermal Power Engineering**  
3-0-0-3-3:


Rotary Thermodynamic devices – Steam turbines & their classifications – Impulse & Reaction type Turbines, Thermodynamics of compressible fluid-flow, equation and continuity – Isentropic flow throughnozzles, velocity diagram, Blade efficiency, optimum velocity ratio, multi-staging, velocity & pressure compounding, losses in turbines, erosion of turbineblades, turbine governing, performance analysis ofturbine, Condensing system.


**Text:**
1. P.K.Nag- Engineering Thermodynamics – TMH ,2/e
2. P K Nag- Power Plant Engg. - TMH Pub

**Reference:**
1. Cengel --- Thermodynamics , 3/e ,TMH
2. Et-Wakil—Power Plant Engineering , MH

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**ME(EE)-491: Thermal Power Engineering Lab. 0-0-3-3-2:**

1. Study of Cut Models – Boilers IC Engines
   - Lanchashire Boiler
   - Bahcock & Willcox Boiler
   - Cochran Boiler
   - Vertical Tubular Boiler
   - Locomotive Boiler
   - 4S Diesel Engine
• 4S Petrol Engine
• 2S Petrol Engine
2. Load Test on 4 Stroke Petrol Engine & Diesel Engine by Electrical Load Box.
3. Load Test on 4 Stroke Diesel Engine by Rope Brake Dynamometer.
6. To find the Calorific Value of Diesel Fuel & Coal by Bomb Calorimeter.
7. To find the Flash Point & Fire Point of Petrol & Diesel Fuel.
8. To find the Cloud Point & Pour Point of Petrol & Diesel Fuel.
9. To find Carbon Particle Percentage in Diesel Engine Exhaust Smoke by Smokemeter and trace theBHP Vs. % Carbon Curve.
11. To find out the Boiler performance – Boiler efficiency & Steam evaporation rate.
12. To visit a Thermal Power Station & study of the followings :
   a) Boiler b) Steam pipe c) Furnace d) Economizer e) Preheater f) Steam turbines g) Alternator
   h) Water treatment plant i) E. S. P.

CH-401: Basic Environmental Engineering & Elementary Biology 3-0-0-3-3:
Basic ideas of environment, basic concepts, man, society & environment, their interrelationship.
Mathematics of population growth and associated problems, Importance of population study in environmental engineering,
definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development.
Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function.
Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide - causes, effects and control/management; Anthropogenic degradation like Acid rain - cause, effects and control. Nature and scope of Environmental Science and Engineering.
Air pollution and control : Atmospheric Composition: Troposphere, Stratosphere,Mesosphere, Thermosphere, Tropopause and Mesopause.
Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.
Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth’s heat budget.
Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).
Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. Smog, Photochemical smog and London smog.
Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification.
Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).
Water Pollution and Control : Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication. Ground water: Aquifers, hydraulic gradient, ground water flow.
Standard and control: Waste water standard [BOD, COD, Oi, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]. Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic.


Environmental Management: Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India. Different international environmental treaty/ agreement/ protocol. 2L

References/Books

EE-401 Electrical Machines-I 3-1-0-4-4:


Text Books:
Reference Books:
2. Electrical Machines, R.K. Srivastava, Cengage Learning

EE-491 Electrical Machines-I Lab. 0-0-3-3-2
1. Study of the characteristics of a separately excited DC generator.
2. Study of the characteristics of a DC motor
3. Study of methods of speed control of DC motor
4. Study of the characteristics of a compound DC generator (short shunt).
7. Polarity test on a single phase transformer & study of different connections of three phasetransformer.
8. Study of equivalent circuit of three phase Induction motor by no load and blocked rotortest.

**EE-402 ELECTRICAL & ELECTRONIC MEASUREMENT  3-0-0-3-3:**

**Measurements:** Method of measurement, Measurement system, Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Error in measurement, Classification of errors, loading effect due to shunt and series connected instruments.

**Analog meters:** General features, Construction, Principle of operation and torque equation of Moving coil, Moving iron, Electrodynamometer, Induction instruments • Principle of operation of the Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers.

**Instrument transformer:** Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Principle of operation of Current & Potential transformer, errors.

**Measurement of Power:** Principle of operation of Electrodynamic & Induction type wattmeter. Wattmeter errors.

**Measurement of resistance:** Measurement of medium, low and high resistances, Megger.

**Measurement of Energy:** Construction, theory and application of AC energy meter, testing of energy meters.

**Potentiometer:** Principle of operation and application of Crompton’s DC potentiometer, Polar and Co-ordinate type AC potentiometer. Application.

**AC Bridges:** Measurement of Inductance, Capacitance and frequency by AC bridges.

**Cathode ray oscilloscope (CRO):** Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO.

**Electronic Instruments:** • Advantages of digital meter over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, Digital multimeter, Digital frequency meter, Signal generator.

**Sensors & Transducers:** • Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.

**Text Books:**


**Reference Books:**


**EE-492 ELECTRICAL & ELECTRONIC MEASUREMENT Lab.  0-0-3-3-2:**

1. Instrument workshop- Observe the construction of PMMC, Dynamometer, Electrothermal and Rectifier type of instruments, Oscilloscope and Digital multimeter.
2. Calibrate moving iron and electrodynamometer type ammeter/voltmeter by potentiometer.
3. Calibrate dynamometer type wattmeter by potentiometer.
4. Calibrate AC energy meter.
9. Measurement of Inductance by Anderson bridge
10. Measurement of capacitance by De Sauty Bridge.

**5th semester:**
HU-501 PRINCIPLE OF MANAGEMENT  3-0-0-3-3:
Basic concepts of management: Definition – Essence, Functions, Roles, Level.
Management and Society– Concept, External Environment, CSR, Corporate Governance, Ethical Standards.
People Management– Overview, Job design, Recruitment & Selection, Training & Development, Stress Management.
Managerial Competencies– Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship
Customer Management– Market Planning & Research, Marketing Mix, Advertising & Brand Management.
Operations & Technology Management– Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.
Text Books:

EE-501 Electrical Machines-II  3-1-0-4-4:
Synchronous Machines: Armature reaction, - Equivalent circuit - Generator load characteristic - Regulation by emf method. Regulation of alternators by MMF and Potier methods - Parallel operation of alternators.. Generators on infinite bus bars, Capability chart of alternators. Electrical load diagram. Determination of Xd, Xq of salient pole machines - Mechanical load diagram, O & V curves - Regulation of salient pole alternators -Three phase and single phase short circuit on alternators - Starting of synchronous motors. Synchronous condensers.Synchronous induction motor.Principles of design. Reluctance machines

Text Books:
2. Electrical Machines, Nagrath & Kothary, TMH
3. Electrical Machines, Theory & Applications, M.N. Bandyopadhyay, PHI
4. Electrical Machines,K. Krishna Reddy, Published by Scitech Publications.

Reference Books:
2. Electric Machinery & Transformes, Irving L. Kosow, PHI
4. Electrical Machines, R.K. Srivastava, Cengage Learning
EE-591 Electrical Machines-II Lab. 0-0-3-3-2:
1. Different methods of starting of a 3 phase Cage Induction Motor & their comparison [DOL, Auto transformer & Star-Delta]
2. Speed control of 3 phase squirrel cage induction motor by different methods & their comparison [voltage control & frequency control].
3. Speed control of 3 phase slip ring Induction motor by rotor resistance control.
4. Determination of regulation of Synchronous machine by
   a. Potier reactance method.
   b. Synchronous Impedance method.
6. Load test on single phase Induction motor to obtain the performance characteristics.
7. To determine the direct axis resistance [Xd] & quadrature reactance [Xq] of a 3 phase synchronous machine by slip test.
8. Load test on wound rotor Induction motor to obtain the performance characteristics.
9. To make connection diagram to full pitch & fractional slot winding of 18 slot squirrel cage Induction motor for 6 poles & 4 pole operation.
10. To study the performance of Induction generator.
11. Parallel operation of 3 phase Synchronous generators.
12. V-curve of Synchronous motor

EE-502 Power System-I 3-1-0-4-4:
Overhead line construction: Line supports, Towers, Poles, Sag, Tension and Clearance, Effect of Wind and Ice on Sag. Dampers.
Insulators: Types, Voltage distribution across a suspension insulator string, String efficiency, Arching shield & rings, Methods of improving voltage distribution across Insulator strings, Electrical tests on line Insulators.
Cables: Types of cables, cable components, capacitance of single core & 3 core cables, dielectric stress, optimum cable thickness, grading, dielectric loss and loss angle.
Performance of lines: Short, medium (nominal, T) and long lines and their representation. A.B.C.D constants, Voltage regulation, Ferranti effect, Power equations and line compensation, Power Circle diagrams.
Generation of Electric Power: General layout of a typical coal fired power station, Hydro electric power station, Nuclear power station, their components and working principles, comparison of different methods of power generation. Introduction to Solar & Wind energy system.
Tariff: Guiding principle of Tariff, different types of tariff.
Indian Electricity Rule-1956: General Introduction.
Text Books:
2. Power System Engineering, Nagrath & Kothery, TMH
3. Elements of power system analysis, C.L. Wodhwa, New Age International.

Reference Books:

EE-592 Power System-I Lab. 0-0-3-3-2:
2. Simulation of DC distribution by network analyzer.
4. Dielectric strength test of insulating oil.
5. Determination of breakdown strength of solid insulating material.
6. Different parameter calculation by power circle diagram
7. Study of different types of insulator.
8. Active and reactive power control of alternator.
9. Study and analysis of an electrical transmission line circuit with the help of PSPICE.
10. Dielectric constant, tan delta, resistivity test of transformer oil.

**EE-503 Control System-I 3-1-0-4-4:**

**Introduction to control system:** Concept of feedback and Automatic control, Effects of feedback, Objectives of control system, Definition of linear and nonlinear systems, Elementary concepts of sensitivity and robustness. Types of control systems, Servomechanisms and regulators, examples of feedback control systems. Transfer function concept. Pole and Zeros of a transfer function. Properties of Transfer function.


**Time domain analysis:** Time domain analysis of a standard second order closed loop system. Concept of undamped natural frequency, damping, overshoot, rise time and settling time. Dependence of time domain performance parameters on natural frequency and damping ratio. Step and Impulse response of first and second order systems. Effects of Pole and Zeros on transient response. Stability by pole location. Routh–Hurwitz criteria and applications.

**Error Analysis:** Steady state errors in control systems due to step, ramp and parabolic inputs. Concepts of system types and error constants.

**Stability Analysis:** Root loci techniques, construction of Root Loci for simple systems. Effects of gain on the movement of Pole and Zeros.


**Control System performance measure:** Improvement of system performance through compensation. Lead, Lag and Lead–lag compensation, PI, PD and PID control.

Text books:
3. Control System Engineering, D. Roy Choudhury, PHI
1. Control Engineering Theory & Practice, Bandyopadhyaya, PHI
2. Control systems, K.R. Varma, Mc Graw hill
6. Modeling & Control of dynamic system, Macia & Thaler, Thompson
8. Modern Control Engineering, Y. Singh & S. Janardhanan, Cengage Learning
10. Automatic Control system, A. William, Wolovich, Oxford

**EE-593 Control System-I Lab. 0-0-3-3-2:**
1. Familiarization with MAT-Lab control system tool box, MAT-Lab- simulink tool box & PSPICE
2. Determination of Step response for first order &Second order system with unity feedback on CRO &calculation of control system specification like Time constant, % peak overshoot, settling time etc. from the response.
3. Simulation of Step response & Impulse response for type-0, type-1 & Type-2 system with unity feedback using MATLAB & PSPICE.
4. Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system tool box for 2nd ordersystem & determination of different control system specification from the plot.
5. Determination of PI, PD and PID controller action of first order simulated process.
6. Determination of approximate transfer functions experimentally from Bode plot.
7. Evaluation of steady state error, setting time, percentage peak overshoot, gain margin, phase margin with addition of Lead

**CS(EE)-501(a ) Data Structure and Algorithm 3-0-0-3-3:**
Introduction: Importance of study of Data structure, Concept of data structure: Data and data structure, Abstract data type and data type. Algorithm and programs, Basic idea of pseudo-code, Algorithm efficiency and analysis, time and space analysis of algorithms-order notations.
Different representation: row major, column major. Sparse matrix, its implementation and usage. Array representation of polynomials. Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.
Nonlinear data structure: Trees:Basic terminologies, forest, tree representation (using array, using linked list). Basic trees, binary tree traversal (Pre-,in-,post-order), threaded binary tree(left, right, full), nonrecursive traversal algorithm using threaded binary tree, expression tree. Binary search tree-operations (creation, insertion, deletion, searching), Height balanced binary tree-AVL tree (insertion, deletion with examples only). B tree orations ((insertion, deletion with examples only)
Graph: Graph definition and concept, (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut vertex/articulation point, pendant node, clique, complete graph, connected—strongly connected component, weakly connected component-path, shortest path, isomorphism. Graph representation/storage implementation- adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity- Depth First Search (DFS), Breadth-First Search (BFS), concept of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge, application. Minimal spanning tree-Prim’s algorithm (Basic idea of greedy methods)
Searching, Sorting: Sorting algorithm, Bubble sort and optimization, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (Concept, of max heap, application-priority queue, radix sort. Searching, sequential search, binary search, interpolation search. Hashing, Hashing functions, collision resolution techniques.
Text Books:
2. Data structure, S.Lipschutz.
3. Data structure and program design in C, Robert L Krusse, B.P.Leung
Reference Books:

**CS(EE)-591(a ) Data Structure and Algorithm Lab. 0-0-3-3-2:**
1. Implementation of array operation
3. Evaluation of expression operation on multiple stack & queues.
4. Implementation of linked lists, inserting, deleting, inverting a linked list, implementation of stacks & queue using linked list.
5. Polynomial addition, Polynomial multiplication
6. Sparse Matrices, Multiplication, addition
7. Recursive and Nonrecursive traversal of Trees
8. Threaded binary tree traversal. AVL tree implementation.

**CS(EE)-501(b) Computer Organization 3-0-0-3-3:**
Basic organization of the stored program in computer and operation sequence for execution of a program. Role of operating systems and compiler/ assembler. Fetch, decode and execute cycle. Concept of operator, operand, registers and storage. Instruction format. Instruction sets and addressing modes. Commonly used number systems. Fixed and floating point representation of numbers.
Memory unit design with special emphasis on implementation of CPU-memory interfacing. Memory organization. Static and dynamic memory, memory hierarchy, associative memory. Cache memory. Virtual memory. Data path design for read/write access.
Design of control unit- hardwired and micro programmed control. Introduction to instruction pipelining.
Introduction to RISC architecture, RISC vs. CISC architecture. I/O operations- Concepts of handshaking. Polled I/O, Interrupt and DMA.
Text Books:
1. Computer System architecture, M.M. Mano, PHI
Reference Books:
3. Computer Organization & design, P. Pal Chaudhuri, PHI

**CS(EE)-591(b) Computer Organization Lab. 0-0-3-3-2:**
1. Familiarity with IC chips e.g.
   (a) Multiplexer
   (b) Decoder
   (c) Encoder
   (d) Comparator
   Truth table verification and clarification from Data-book.
2. Design an Adder/Subtractor composite unit.
3. Design a BCD adder
5. Use of a multiplexer unit to design a composite ALU.
6. Use of an ALU chip for multibit arithmetic operation.
7. Implementations of read write operation using RAM IC.
8. Cascade two RAM ICs for vertical and horizontal expansion.

**CS(EE)-591(c) MICROPROCESSOR & MICROCONTROLLER 3-0-0-3-3:**
Introduction to Computer architecture: Architecture of a typical Microprocessor, Bus configuration, The CPU module, ROM & RAM families, Introduction to assembly language & machine language programming, Instruction set of typical microprocessor (e.g. 8085), Subroutine & stack, Timing diagram, Memory Interfacing, Interfacing input output port, Interrupt & interrupt handling, Serial & parallel data transfer scheme, Programmed & interrupt driven data transfer, Direct memory access, Programmable peripheral devices, Programmable interval timer, Analog input-output using AD & DA converter.
Assembly language programme of a typical Microprocessor: Use of compilers, assembler, linker & debugger.
Basic 16 bit Microprocessor (e.g. 8086): Architecture, Min-max mode.
Introduction to microcontroller: Architecture & instruction set of a typical microcontroller (e.g. PIC16F84 device), Feature of popular controller (processor 8031/8051), its programming & interfacing.

Text Books:
1. Microprocessor architecture, programming & application with 8085, R. Gaonker, Penram International.
4. The 8051 microcontroller, Ayala, Thomson.
5. Interfacing through Microprocessors ,E. Srinivasa Reddy, Published by Scitech Publications (India) Pvt. Ltd.

Reference Books:
2. An introduction to the Intel family of Microprocessors, James L. Antonakos, Pearson Education,
3. The 8051 Microcontroller and Embedded systems, Muhammad Ali Mazidi & J. G. Mazidi, Pearson Education.

CS(EE)-591(c ) MICROPROCESSOR & MICROCONTROLLER Lab. 0-0-3-3-2:
1. Familiarization with 8085 register level architecture and trainer kit components including the memory map.
   Familiarization with process of storing and viewing the contents of memory as well as registers.
2. (a) Study of prewritten program on trainer kit using the basic instruction set (data transfer, load/store, arithmetic, logical)
   (b) Assignment based on that.
3. (a) Familiarization with 8085 simulator on PC
   (b) Study of prewritten program using basic instruction set (data transfer, load/store, arithmetic, logical).
   (e) Assignment based on that.
   (a) Lookup table
   (b) Copying a block of memory
   (c) Shifting a block of memory.
   (d) Packing and unpacking of BCD numbers.
   (e) Addition of BCD number
   (f) Binary to ASCII conversion
   (g) String matching
5. Program using subroutine calls and using IN/OUT instruction using 8255 PPI on the trainer kit e.g. subroutine for
delay, reading switch state and glowing LEDs accordingly, finding out frequency of pulse train etc.
6. Interfacing any 8 bit latch (74LS373) with trainer kit as a peripheral mapped output port with absolute address
decoding.
7. Interfacing with I/O module:
   (a) ADC
   (b) Speed control of DC motor with DAC
   (c) Keyboard
   (d) Multi digit display with multiplexing.
   (e) Stepper motor
8. Study of 8031/8051 Micro controller kit and writing program for the following task using the kit
   (a) table look up
   (b) basic arithmetic and logical operation
   (c) interfacing of keyboard and stepper motor.

CS(EE)-501(d ) Computer Architecture 3-0-0-3-3:
Introduction: Review of basic computer architecture(Revisited), Quantitative techniques in computer design, measuring and reporting performance.
Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance.
Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.
Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, superpipelined and VLIW processor architectures. Array and vector processors.
Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.
Text books: [To be detailed]

**CS(EE)-591(d) Computer Architecture Lab. 0-0-3-3-2:**
1. HDL introduction
2. Basic digital logic base programming with HDL
3. 8-bit Addition, Multiplication, Division
4. 8-bit Register design
5. Memory unit design and perform memory operations.
6. 8-bit simple ALU design
7. 8-bit simple CPU design
8. Interfacing of CPU and Memory

**EE-581 Seminar 0-0-3-3-2:**
Each and every student have to appear in Group Discussion, Self Introduction, Technical seminar & non-technical seminar on very recent topics.

**6th semester:**

**EE-601 Control System –II 3-1-0-4-4:**


**Text Books:**
1. Control System Engineering, D. Roy Chowdhuri, PHI

Reference Books:
3. Control Theory & Practice, M.N. Bandyopadhyaya, PHI
8. System Dynamics and Control, Eronini Umez, Eronini, Thomson
9. Modern Control System, R.C. Dorf & R.H. Bishop, Pearson Education
10. Control Engineering, Ramakalyan, Vikas
11. Control System R& Engineering, A. Natarajan Reddy, Scitech
12. Control System Theory with Engineering Application, Lyshevski, Jaico

EE-691 Control System –II Lab. 0-0-3-3-2:
1. Study of a practical position control system obtaining closed step responses for gain setting corresponding to overdamped and under-damped responses. Determination of rise time and peak time using individualized components by simulation. Determination of un-damped natural frequency and damping ratio from experimental data.
2. Tuning of P, PI and PID controller for first order plant with dead time using Z-N method. Process parameters (time constant and delay/lag) will be provided. The gain of the controller to be computed by using Z-N method. Steady state and transient performance of the closed loop plant to be noted with and without steady state disturbances. The theoretical phase margin and gain margin to be calculated manually for each gain setting.
4. Obtain Transfer Function of a given system from State Variable model and vice versa. State variable analysis of a physical system - obtain step response for the system by simulation.
5. State variable analysis using simulation tools. To obtain step response and initial condition response for as single input, two-output system in SV form by simulation.
7. Study of the effects of nonlinearity in a feedback controlled system using time response. Determination of step response with a limiter nonlinearity introduced into the forward path of 2nd order unity feedback control systems. The open loop plant will have one pole at the origin and other pole will be in LHP or RHP. To verify that (i) with open loop stable pole, the response is slowed down for larger amplitude input (ii) for unstable plant, the closed loop system may become oscillatory with large input amplitude by simulation
8. Study of effect of nonlinearity in a feedback controlled system using phase plane plots. Determination of phase plane trajectory and possibility of limit cycle of common nonlinearities.

EE-602 Power Systems-II 3-1-0-4-4:
Representation of Power system components: Single-phase representation of balanced three phase networks, the one-line diagram and the impedance or reactance diagram, per unit (PU) system.
Distribution Substation: Types of substations, location of substations, substation equipments and accessories, earthing (system & equipment), feeder and distributors, radial and loop systems.
Faults in Electrical systems: Transient on a transmission line, short circuit of a synchronous machine under no load &
loaded condition. Symmetrical component transformation, sequence impedance and sequence network of power system, synchronous machine, transmission lines and transformers. Symmetrical component analysis of unsymmetrical faults, single line to ground fault, line to line fault, double line to ground fault.

**Power system stability:** Steady state stability, transient stability, equal area criteria, swing equation, multi-machine stability concept.

**Power system protection:** Protective zones, Relaying elements and quantities. Protective relays, basic requirements and type of protection, phase and amplitude comparator, grading (time & current), classification of Electromagnetic relays, Directional relay, Distant relay, Differential relay, basic aspects of static and digital relays, relay protection scheme for transformer, feeder, generators and motors. Circuit breakers, circuit breaking transients, transient recovery voltage, current chopping and resistance switching, circuit breaker rating, arc and arc extinction, circuit breaker types, oil circuit breaker, vacuum circuit breaker, air blast circuit breaker, SF6 circuit breaker and operating mechanism, advantages and disadvantages of different types.

**Text Books:**
2. Electrical Power Systems, Subir Ray, PHI

**Reference Books:**

**EE-692 Power Systems-II Lab.0-0-3-3-2:**
1. Study of the characteristics of on delay relay and off delay relay.
2. Test to find out polarity, ratio and magnetization characteristics of CT and PT.
3. Test to find out characteristics of (a) under voltage relay (b) earth fault relay.
4. Study on DC load flow
5. Study on AC load flow using Gauss-seidel method
7. Study on Economic load dispatch.
8. Study of different transformer protection schemes by simulation.
9. Study of different generator protection schemes by simulation.
10. Study of different motor protection schemes by simulation.
11. Study of different characteristics of over current relay.
12. Study of different protection scheme for feeder.

**EE-603 Power Electronics 3-1-0-4-4:**
**Introduction:** Concept of power electronics, application of power electronics, uncontrolled converters, advantages and disadvantages of power electronics converters, power electronics systems, power diodes, power transistors, power MOSFETs, IGBT and GTO.

**PNPN devices:** Thyristors, brief description of members of Thyristor family with symbol, V-I characteristics and applications. Two transistor model of SCR, SCR turn on methods, switching characteristics, gate characteristics, ratings, SCR protection, series and parallel operation, gate triggering circuits, different commutation techniques of SCR.

**Phase controlled converters:** Principle of operation of single phase and three phase half wave, half controlled, full controlled converters with R, R-L and RLE loads, effects of free wheeling diodes and source inductance on the performance of converters. External performance parameters of converters, techniques of power factor improvement, single phase and three phase dual converters.
**DC-DC converters:** Principle of operation, control strategies, step up choppers, types of choppers circuits based on quadrant of operation, performance parameters, multiphase choppers and switching mode regulators.

**Inverters:** Definition, classification of inverters based on nature of input source, wave shape of output voltage, method of commutation & connections. Principle of operation of single phase and three phase bridge inverter with R and R-L loads, performance parameters of inverters, methods of voltage control and harmonic reduction of inverters. Brief idea of Resonant Pulse inverters.

**AC controllers:** Principle of on-off and phase control, single phase and three phase controllers with R and R-L loads. Principle of operation of cycloconverters, circulating and non circulating mode of operation, single phase to single phase step up and step down cycloconverters, three phase to single phase Cycloconverters, three phase to three phase Cycloconverters.

**Applications:** Speed control of AC and DC motors. HVDC transmission. Static circuit breaker, UPS, static VAR controller.

**Text Books:**
1. Power Electronics, K. Hari Babu, Published by Scitech Publications.
4. Power Electronics, M.H. Rashid, PHI, 3rd Edition

**Reference Books:**
2. Power Electronics, Mohan, Undeland & Riobbins, Wiley India
5. Power Electronics, M.S. Jamil Asghar, PHI, 2007
6. Analysis of Thyristor power conditioned motor, S.K. Pillai, University Press.
7. Power Electronics : Principles and applications, J.M. Jacob, Thomson

**EE-693 Power Electronics Lab. 0-0-3-3-2:**
1. Study of the characteristics of an SCR.
2. Study of the characteristics of a Triac
3. Study of different triggering circuits of an SCR.
4. Study of firing circuits suitable for triggering SCR in a single phase full controlled bridge.
5. Study of the operation of a single phase full controlled bridge converter with R and R-L load.
8. Study of performance of single phase controlled converter with and without source inductance (simulation)
10. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter.
14. Study of performance of a Dual converter. (simulation)
15. Study of performance of a Cycloconverter (simulation)

**CS(EE)-601(a) Software Engineering 3-1-0-4-4:**
Overview of system analysis & design: Business system concept, System development life cycle, waterfall model, Spiral Model, Feasibility Analysis, Technical feasibility, Cost-benefit Analysis, COCOMO model.
System design: Context diagram and DFD, Problem partitioning, Top down and bottom up design, decision tree, decision table and structured English, Functional Vs object oriented approach.
Testing: Levels of testing, Integration testing, Test case specification, Reliability assessment, Validation & Verification metrics, Monitoring & control.
System project management: Project scheduling, Staffing, software configuration management, Quality assurance, Project monitoring.
Fundamentals of Object oriented design in UML: Static and dynamic models, necessity of modeling, UML diagrams, Class diagrams, Interaction diagrams, Collaboration diagram, Sequence diagram, State chart diagram, Activity diagram, Implementation diagram.

Text Books:
1. Software Engineering, R.G. Pressman, TMH
2. Software Engineering Fundamental, Behforooz, OUP
3. Software Engineering, Ghezzi, PHI

Reference Books:
1. An integrated approach to Software Engineering, Pankaj Jalote, Narosa
2. Software quality, Benmenachen, Vikas
3. IEEE standard on Software Engineering.
4. Software defect Prevention, Kane, SPD.
5. Essentials of Software Engineering, Uma, Jaico

CS(EE)-691(a) Software Engineering 0-0-3-3-2:
Pre-requisite: For the software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE tools.
1. Preparation of requirement document for proposed project in standard format.
2. Project schedule preparation using tools like MSP project, Generation of Gantt and PERT chart from schedule. Prepare project management plan in standard format.
3. Draw Use case diagram, Class diagram, Sequence diagram and prepare Software design document using tools like Rational Rose.
4. Estimate project size using Function Point (FP)/Use Case Point. Use Excel/Open Office template for calculation.
5. Design Test Script/Test Plan (both Black box and White Box approach) for a small component of the proposed project. Develop that component using programming languages like c/Java/VB etc.
6. Generate test result and perform defect cause analysis using Pareto or Fishbone diagram.
7. Compute Process and Product Metrics (e.g. Defect Density, Defect Age, Productivity, Cost etc.).
8. Familiarization with any Version control system like CVS/VSS/PVCS etc. Following projects can be used as dummy projects:
   - Library management system
   - Railway reservation system
   - Employee payroll
   - Online banking system
   - Online Shopping Cart
   - Online Examination

CS(EE)-601(b) DBMS 3-1-0-4-4:
Introduction: Concept & Overview of DBMS, Data model, Database language, Database administrator, Database users, Three Schema architecture of DBMS.
Relational Model: Structure of relational Databases, Relational Algebra, Relational calculus, Extended Relational Algebra operations, Views, Modification of the Database.
SQL and Integrity Constraints: Concept of DDL, DML, DCL. Basic structure, Set operations, Aggregate functions, Null values, Domain constraints, Referential integrity, Constraints, assertions, views, Nested sub queries, Data base security application development using SQL, Stored procedures and triggers.
Relational Database design: Functional dependency, Different anomalies in designing a Database, Normalization using functional dependencies, Decomposition, Boyce-Codd normal form, 3NF, Normalization using multi-valued dependencies, 4NF, 5 NF.
Internal of RDBMS: Physical data structures, Query optimization: join algorithm, statistics and cost base optimization, Transaction processing, Concurrency control and recovery management: transaction model properties, state serializability, look base protocols, two phase locking.
File organization & index structures: File & records concepts, Placing file records on disk, Fixed and variable sized records, Types of single –Level index (primary. Secondary, clustering), Multilevel Indexes, Dynamic multilevel indexes using B tree and B+ tree.

Text Books:
2. Database Management system, Ramakrishnan, Mc Graw Hill.

Reference Books:

CS(EE)-691(b)  DBMS Lab. 0-0-3-3-2:
1. Creating Database:
   • Creating a Database
   • Creating a table
   • Specifying Relational Data Types
   • Specifying Constraints
   • Creating Indexes.
2. Table and record Handling
   1. INSERT statement
   2. Using SELECT and INSERT together
   3. DELETE, UPDATE, TRUNCATE statements
   4. DROP, ALTER statements
3. Retrieving Data from Database
   • The SELECT statement
   • Using the WHERE clause
   • Using Logical Operators in the WHERE clause
   • Using IN, BETWEEN, LIKE, ORDER,BY GROUP BY and HAVING
4. Clause
   • Using AGGREGATE function
   • Combining Tables using JOINS
   • Sub queries
5. Database Management
   • Creating views
   • Creating Column Aliases
   • Creating Database Users

CS(EE)-601(c) Object Oriented Programming 3-1-0-4-4:
Object oriented Design: Concept of Object oriented programming language, Major and minor elements, Object,Class, relationship among objects, aggregation, links, relationship among classes-association, aggregation using instantiation, meta-class, grouping constructs.
Object oriented concept: Difference between OOP and other conventional programming, advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism.
Basic concepts of Object oriented programming usingJava: Class & Object properties: Basic concepts of Java programming-advantages of Java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested and inner classes, basic string handling concepts, -String (discuss char(), compare(), equals(), equalsIgnoreCase(), indexOff(), length(), substring(), toCharArray(), toLowerCase(), toUpperCase(), methods), concept of mutable and immutable string, command line arguments, basics of I/O operations-keyboard input using BufferedReader & Scanner classes. Reusability properties: Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes, &methods, interfaces. Creation of packages, importing packages, member access for packages. Exception
handling & Multithreading: Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread synchronization, inter thread communication, deadlocks for threads, suspending & resuming threads.

Applet Programming (using swing): Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applet in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields.

Text Books:
1. Object Oriented Modeling and design, James Rambaugh & Michael Blaha, PHI.
2. Object Oriented Programming with C++ and Java, D. Samanta, PHI
3. Programming with Java: A Primer, E. Balagurusamy, TMH.

Reference Books:
2. The complete reference Java2, Patrick Naughton & Herbert Schildt, TMH

CS(EE)-691(c) Object Oriented Programming Lab. 0-0-3-3-2:
1. Assignments on class, constructor, overloading, inheritance, overriding.
2. Assignments on wrapper, class, arrays.
3. Assignments on developing interfaces-multiple inheritance, extending interfaces.
4. Assignments on creating and accessing packages.
5. Assignments on multithreaded programming.
6. Assignment on applet programming

CS(EE)-601(d) Computer Network 3-1-0-4-4:
Overview of Data Communication and Networking: Introduction, Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN);
Physical Level: Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit Switching: time division & space division switch, TDM bus; Telephone Network.
Data link Layer: Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC;
Medium Access sub layer: Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet (in brief).
Transport layer: Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop, TCP chokepackets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,
Application Layer: Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.
Modern topics: ISDN services & ATM, DSL technology, Cable Modem: Architecture and operation in brief. Wireless LAN: IEEE 802.11, Introduction to blue-tooth.

Text Books:
1. Data Communications and Networking (3rd Ed.), A. Forouzan, TMH
3. Data and Computer Communications (5th Ed.), W. Stallings, PHI/ Pearson Education

Reference Books:
1. Computer Networking - A top down approach featuring the internet, Kurose and Rose Pearson Education
2. Communication Networks, Leon, Garica, Widjaja, TMH
3. Communication Networks, Walrand, TMH.

**CS(EE)-691(d) Computer Network Lab. 0-0-3-3-2:**
1. Assignments on class, constructor, overloading, inheritance, overriding.
2. Assignments on wrapper, class, arrays.
3. Assignments on developing interfaces—multiple inheritance, extending interfaces.
4. Assignments on creating and accessing packages.
5. Assignments on multithreaded programming.
6. Assignment on applet programming

**EE-604(a) High Voltage Engineering 4-0-0-4-4:**


**Measurement of High Voltage:** Sphere gap voltmeter, AC, DC and impulse high voltage measurement as per Indian Standard Specifications. Resistance and Capacitance Potential dividers, Peak voltmeters for measurement of high AC voltage in conjunction with capacitance dividers. Capacitance Voltage Transformer, Rotating Voltmeter for the measurement of DC high voltage, Electrostatic Voltmeter.

**Transient in power systems:** Lightning Phenomena, Electrification of cloud, Development of Lightning Stroke, lightning induced over voltage, direct stroke, indirect stroke. Protection of Electrical Apparatus against over voltage, Lightning Arresters, Valve Type, Metal Oxide arresters, Expulsion type. Effect of location of lightning arresters on protection of transformer. Protection of substation, Ground wires. Insulation Co ordination, Basic Insulation level. Basic Impulse level, Switching Impulse level. Volt time characteristics of protective devices, Determination of Basic Impulse level of substation equipment.

**High Voltage Testing:** High Voltage testing, Testing as per Indian Standard Specifications, Power frequency withstand, induced over voltage and impulse test on transformers, Power frequency wet withstand test and impulse test on insulators.

**Text Books:**

**Reference Books:**

**EE-604(b) Illumination Engineering 4-0-0-4-4:**

**Measurement of light:** Measurement of light - radiometric and photometric quantities, units of measurement.
standardization. Measurement of light distribution, direct and diffused reflection, fundamental concepts of colourimetry and measurement of colour.

**Lamp, accessories & luminaries:** Light production by gas discharge, fluorescence, incandescence, daylight principle of operation, light efficacy, color, electrical characteristics, typical applications, dimming condition of GLS filament, tungsten halogen lamps, fluorescent tubes, compact fluorescent lamp (CFL), low and high pressure sodium lamps, high pressure mercury lamp, metal halide lamp. Functions of luminaries, classification, Materials Used in luminaries manufacturing, reflection, refraction, diffusion, polarization and optical design, photometric measurements, application data and its use. LED.

**Interior lighting:** Objectives quantity and quality of light, selection of lamps, luminaries section, placement. Design considerations for lighting of offices, conference rooms, hospitals, teaching places, house etc., design calculations.

**Lighting control:** Types of lighting controls, strategy for selection, benefits of lighting control. Electric distribution system for lighting, maintenance strategies, group replacements schedule. Techniques of achieving energy efficient lighting design, role of computers in lighting design, advantages and limitations of computer aided lighting design.

**Text Books:**
1. Utilization of Electric Power, C.L. Wadha, New Age International Ltd.
2. Generation, Distribution and Utilization of electrical energy, C.L. Wadha, New Age International Ltd.

**EE-604(c) Energy Management and Audit 4-0-0-4-4:**
Basics of energy and its various forms: (a) thermal (b) Electricity (c) Non-Conventional Sources Thermal: Different Fuels & its Energy Contents, Temperature & Pressure, Heat Capacity. Steam and Moist Air.
Electricity: AC & DC, Load Management, Maximum Demand Control, Aggregated Technical & Commercial Losses (ATC), Electricity Tariffs.
Energy Audit: Definition, Requirements for Energy Audit, Different Approaches viz, Preliminary and Detailed Energy Audit, Case Studies for Real Systems.
Books:
3. www.bee.org
REFERENCES:
1. NPC energy audit manual and reports

**EE-604(d) RENEWABLE & NON CONVENTIONAL ENERGY 4-0-0-4-4:**
Introduction to Energy sources: Renewable and non-renewable energy sources, energy consumption as a measure of Nation’s development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment, Kyoto Protocol.
Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solarradiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond, solar
water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaics - solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems & its applications. PV hybrid systems.

**Wind Energy:** Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

**Energy from Biomass:** Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.

**Geothermal Energy:** Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

**Energy from Ocean:** Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.

**Magneto Hydrodynamic power generation:** Principle of MHD power generation, MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects.


**Fuel cell:** Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells.

**Text Books:**
5. Renewable energy sources and conversion technology, Bansal Keemann, Meliss, Tata Mc Graw Hill.

**Reference Books:**
1. Renewable energy resources and emerging technologies, D.P. Kothari, Prentice Hall of India Pvt. Ltd.

**Seventh semester:**

**EE-701 Electric Drives 4-0-0-4-4:**


**Motor power rating:** Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating for continuous, short time and intermittent duty, equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads. Effect of load inertia & environmental factors.

**Stating of Electric Drives:** Effect of starting on Power supply, motor and load. Methods of stating of electric motors. Acceleration time, Energy relation during stating, methods to reduce the Energy loss during starting.

**Braking of Electric Drives:** Types of braking, braking of DC motor, Induction motor and Synchronous motor, Energy loss during braking.

**DC motor drives:** Modeling of DC motors, State space modeling, block diagram & Transfer function, Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor current chopper controlled DC motor drives.

**Induction motor drives:** Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/Hertz Control, Vector or Field oriented control.

**Synchronous motor drives:** Variable frequency control, Self Control, Voltage source inverter fed synchronous motor drive, Vector control.
Introduction to Solar and Battery Powered Drive, Stepper motor, Switched Reluctance motor drive.

**Industrial application:** Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives.

**Text Books:**
2. Electric Drives, Vedam Subrahmanyan, TMH.
4. Electrical Machines and Drives, Manikandan, Published by Scitech Publications (India) Pvt. Ltd.

**Reference Books:**
1. Electric motor drives, R. Krishnan, PHI.
3. Electric Motor & Drives, Austin Hughes, Newnes.

**EE-791 Electric Drives Lab. 0-0-3-3-2:**
1. Study of thyristor controlled DC Drive.
2. Study of Chopper fed DC Drive.
3. Study of AC Single phase motor-speed control using TRIAC.
4. PWM Inverter fed 3 phase Induction Motor control using PSPICE / MATLAB / PSIM Software.
5. VSI / CSI fed Induction motor Drive analysis using MATLAB/DSPICE/PSIM Software.
7. Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software.
10. PC/PLC based AC/DC motor control operation.

**HU-701 Financial Management & Accounts 3-0-0-3-3:**
Management of Working Capital: Various concepts, Elements, Classification, Financing and importance of working capital, Investment analysis, Cash flow determination, cost of capital, capital budgeting methods.
Budgeting Control Technique: Concepts of budget, budgeting and budgetary control, Objectives, Functions, Uses, Advantages, Limitations; Master Budget and Report.
Cost - Volume - Profit Analysis: Classification of costs, Allocation, apportionment and absorption, Cost centers, different costing systems, Cost analysis for managerial decisions, Meaning of Linear CVP analysis, Objectives, Assumptions, Break-Even analysis, determining the Break-Even point profit, Volume graph profit, Volume ratios margin of Safety.
Introduction to Accounting: Basic accounting concepts, important definitions, uses, limitations, advantages; types of Accounting, Financial statements, introduction to Journal Accounting; different types of Vouchers, double entry bookkeeping, different types of transactions related to Financial Accounting.
Financial Control: Posting of Ledgers and preparation of Trial Balance; preparation of Balance Sheet and Profit and Loss Accounts; Controlling other departments by Financial Accounting (A practical Approach).

Books:
3. Advanced Management Accounting - Kaplan & Atkinson, PHI.
5. Financial Mgmt Accounting, Gupta,Pearson
6. Financial Mgmt, I.M. Pandey, Vikas
7. Financial Mgmt., Khan & Jain, TMH
8. Financial Mgmt , Memenamin, OUP
EE-702(a)  Power System III  3-0-0-3-3:
Economic Operation of Energy Generation Systems: Generation Cost Curves; Economic Operation of Thermal System; Plant Scheduling; Transmission Loss and PenaltyFactor; Hydro-Thermal Scheduling; Concept of Reserves and Constraints; Unit Commitment.
Automatic Generation Control: Concept of AVR and ALFC Loops, Significance of Double Loop in ALFC; Exciter and VAR Control; Single AreaLoad Frequency Control; Two Area Load Frequency Control; Frequency Response.
Compensation in Power System: Reactive Power Sensitivity and Voltage Control; Load Compensation with Capacitor Banks; Line Compensation withReactors; Shunt and Series Compensation; Fixed Series Capacitors; Thyristor Controlled Series Capacitors;Introduction to SVC and STATCOM.
Power System Transients: Types of System Transients; Overvoltage in Transmission Lines; Propagation of Surges and Travelling Waves;Protection Against Lightning and Surges;
Text Books
2. Power System Analysis, Granger and Stevenson, Mc Graw Hill
Reference Books:
3. Power system Analysis, Nagsarkar & Sukhija, Pearson
4. Power system analysis, operation and control, Chakrabarti and Halder, PHI
5. Book of Elgand.

EE-702(b)  Control System-III  3-0-0-3-3:
Sliding Mode Control:Overview of SMC, Motivating Examples, Stabilization of second order system;Advantages and disadvantages.
Text Books:
Reference Books:
1. Adaptive control system, K.J. Astrom and B. Wittenamark, Addision WesleyPublishing Co

EE- 702(c )Electrical Machines-III  3-0-0-3-3:
Generalised Theory of Electric machines.
Transients and dynamics of A.C Machines, Synchronous and Induction machines.
Direct Current machine Dynamics.
Space Vectors and its application to the analysis of electrical machines specially induction motors.
Motor behavior under asymmetrical voltage supply.
Harmonic effects on induction motor- harmonic equivalent circuit and harmonic torque.

References:
1. Electrical Machines, M.S.Sarma and M.K. Pathak, Cengage Learning
2. P.S Bimbra, Generalised theory of Electrical Machines, Khanna Publications
3. B.K Bose, Modern Power Electronics and a.c drive, Pearson Education
4. R. Krishnan, Electric Motor Drive, Prentice Hall of India(P) Ltd

**EE- 702(d) Advanced Power Electronics 3-0-0-3-3:**
DC-DC converters: Analysis and detailed design of buck, boost, buck-boost, Cuk and SEPIC converters, Analysis and detailed design of isolated dc-dc converters including forward, flyback, push-pull, full bridge and dual-active bridge topologies, Continuous and discontinuous current modes of operation, Linearized, small-signal average models of dc-dc converters, Voltage mode and current mode control design methods, Design of magnetics for dc-dc converters, Power management, Switching regulators for modern processors – multi-phase voltage regulators, design for high dynamic performance, switched capacitor converters, features of power management integrated circuits
Digital control of power electronic converters: Review of digital control systems, Digital control techniques for power converters; modeling and simulation.
Design examples of multi-phase VR, and PWM dc-ac converter, AC-DC PWM rectifiers.
Power quality issues: Boost and flyback converter based power factor correction circuits (PFC), Models, design and control of PFC, Full bridge bi-directional PWM rectifiers, applications in front end of motor drives, DC-AC PWM inverters, Voltage source inverters - topology and PWM techniques, Models of single phase and three phase inverters and control methods, Applications in low frequency AC synthesis.
Three-phase PWM techniques: Grid interface of renewable energy resources, Power converters and control for interfacing solar and wind energy to grid, Distributed generation and impact on power distribution systems, Microgrids and smart grid technologies using power electronic converters.
Soft switching and resonant converters: Concept of ZVS and ZCS, Zero voltage transition converters, Resonant converters and applications in lighting
Practical issues in power electronic converters:Selection criteria for diodes, MOSFETs and IGBTs; gate drive circuits, Thermal management, EMI and layout issues

**Books:**
3. NPTEL http://nptel.iitm.ac.in

**EE-703(a)  Power Plant Instrumentation& Control  3-0-0-3-3:**
Concepts of Power plants of different types: Setups, energy conversions and measurement requirements, examples of Thermal, Hydal, and Nuclear plants. Thermal power plant and system instrumentation.
Instrumentation for (i) Turbines (ii) Condensers (iii) Generators (iv) Coal handling (v) Water treatment (vi) Feed water, combustion air and flue gases
Control: Boiler Control - Steam pressure control, combustion control, Furnace Draft control, Steam temperature control, Feed water control, Data logger and computer control, supervisory control and monitoring system.
Instrumentation for safety interlocks - protective gears, emergency measures, Alarm systems and Analysis etc. Pollution measurement, monitoring and control.
Data handling-processing, logging, acquisition, accounting, display and storage.
Instrumentation for Generator and Busbar coupling. Introduction to power plant modeling/simulation

**Text Books:**
EE-703(b) Sensors and Transducers 3-0-3-3:


Text Books:

EE-703(c) Biomedical Instrumentation 3-0-3-3:


Books:
1. Handbook of Biomedical Instrumentation, R S Khandpur, Tata –Mcgraw Hill Education
6. Design of Micro-controller based Medical Instrumentation, J Tompkins & J G Webster, Prentice Hall Inc

**EE-703(d) PROCESS CONTROL  3-0-0-3-3:**
Process reaction curves, Controllability-using (i) deviation reduction factors (ii) gainbandwidth product, State controllability.Tuning controllers: both closed and open loop methods (Ziegler-Nichols, Cohen, PRC method and 3-C method of parameter adjustment) Electronic PID controller design Pneumatic controllers-brief analysis. Different control strategies-schemes, brief analysis and uses (i) Ratio control (ii) Cascade control (iii) Feed forward control (iv) Multivariable control
Final control element: actuators (Pneumatic actuators, Electrical actuators) and controlvalves (Globe, Ball, Butterfly, Gate, Pinch), different parts, Fail Position, Valve Characteristics, Cv, single & Double seated valves, Valve sizing, Valve selection, Cavitation, Flashing, Noise. Control valve accessories - Air filter regulator, I/P converter, Pneumatic positioner, ElectroPneumatic positioner, limit switches, Motion transmitter. Brief study of safety valves and Solenoid valves.
Introduction to Programmable Logic controllers- Basic Architecture and function, Inputoutputmodules and interfacing, CPU and memory, Relays, Timers, Counters and their uses, PLC programming and applications, Introduction to DCS

**Books:**
1. Principle of Process control, D. Patranabis, TMH
4. Chemical process control, G. Stephanopoulos, PHI
5. Process control instrumentation technology, C.D. Johnson, PHI

**EC(EE)-701(a ) RF & Microwave Engg :  4-0-0-4-4:**
Introduction:RF& Microwave Spectrum, Typical applications of RFand Microwave, Safety considerations.
Microwave Waveguide and Waveguide Resonator: Rectangular Waveguide- Design consideration, TE & TM modes, TE10mode analysis, cut-off frequency, propagation constant, intrinsic wave impedance, phase and group velocity, power transmission, attenuation, waveguide excitation, wall current; Introduction of circular waveguide; Rectangular waveguide resonator- Design consideration, resonant frequency, Q-factor, excitation.
Planar Transmission line: Micro-strip lines, Coplanar waveguide, Slot line-design consideration, field patterns, propagation characteristics, Comparison for different characteristics of the above mentioned lines.
High frequency Circuit Elements: Difference in High frequency and relatively low frequency behavior of Lumped circuit components. Miniaturization and Design of Lumped components at High RF. Realization of reactive elements as Waveguide and Planar Circuit components.
Waveguide Passive Components and their S-matrix Representation: N-port networks-Properties of S matrix, Transmission matrix & their relationships; Microwave passive components and their S matrix representation: Attenuators, Phase shifter, Directional coupler, Bethe-hole coupler, Magic tee, hybrid ring, Circulators, Isolators; Design procedure of filter (maximally flat and equal ripple) using insertion loss method-specification, low-pass prototype design, scaling and conversion, implementation.

Microwave Tubes: Electron beam & Field interaction for energy exchange in resonant (two cavity klystron, Reflex Klystron, Magnetron) and non-resonant (TWT &BWO) microwave active devices: Typical characteristics & applications (only physical explanation is required, no mathematical derivation required).

Semiconductor Microwave devicesTED (Gunn diode) & Avalanche Transit Time (IMPATT) device, Schottky diode, PIN diode- characteristics & applications; Microwave bipolar transistor, Microwave field effect transistor(MESFET).

Microwave Amplifier Design: Basic consideration in the design of RF amplifier- Transistor S-parameter, Stability, matching network, noise figure; Matching network design using lumped elements and L-Section. Brief introduction to NBA, LNA.

Typical Microwave Test Bench & measurement: VSWR meter, Tunable detector, Slotted line and Probe detector, Frequency meter, Network analyzer, Measurement of VSWR – low, medium and high, Measurement of power: low, medium and high, Frequency measurement.

Books:
1. Microwave Engineering, 3Rd Ed David M. Pozar, Willey & Sons Inc.
3. Microwave Engineering, A Das & S Das, TMH.
4. Microwave Devices & Circuits, SY Liao , PearsonEducation /PHI
5. Microwave Engineering-Passive Circuits, PA Rizzi , Pearson Education.

EC(EE)-791(a) RF & Microwave Engg Lab : 4-0-0-4-4:
1. Determination of phase and group velocities in a waveguide carrying TE Wave from Dispersion diagram [ω−β Plot].
2. Measurement of unknown impedance using shift in minima technique using a waveguide test bench/ Measurement of the susceptance of an inductive and or a capacitive window using shift in minima technique using a waveguide test bench
3. Study of the characteristics of a Reflex Klystron oscillator
5. Measurement of coupling factor, Directivity, Insertion loss and Isolation of a Directional coupler using X-band waveguide test bench set up.
7. Experimental/Simulation Study of filter (LPF, HPF,BPF) response.
8. Measuring of dielectric constant of a material using waveguide test bench at X-band.

EC(EE) -701(b) Digital Signal Processing 4-0-0-4-4:
Discrete-time signals: Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem, sequences-periodic, energy, power, unit-sample, unit step, unit ramp & complex exponentials, arithmetic operations on sequences.

LTI systems: Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercise, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non recursive systems.

Discrete Time Fourier Transform(DTFT): Concept of frequency in discrete and continuous domain and their relationship (radian and radian/sec), freq. response in the discrete domain.Discrete system's response to sinusoidal/complex inputs (DTFT), Representation ofLTI systems in complex frequency domain.

Z- Transforms: Definition, mapping between s-plane & z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequenceswith examples & exercises, characteristic families of signals along with ROC, convolution, correlation and multiplication using Z- transform, initial value theorem, Perseval’s relation, inverse Z-
transform by contour integration, power series & partial-fraction expansions with examples and exercises.

Discrete Fourier Transform: Concept and relations for DFT/IDFT, Relation between DTFT & DFT. Twiddle factors and their properties, computational burden on direct DFT, DFT/DFT as linear transformation, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circulation convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences-Overlap-Save and Overlap-Add methods with examples and exercises.


Filter design: Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transform, design of linear phase FIR filters no. of taps, rectangular, Hamming and Blackman windows. Effect of quantization.

Digital Signal Processor: Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in assembly Language.

FPGA: Architecture, different sub-systems, design flow for DSP system design, mapping of DSP algorithms onto FPGA.

Books:
1. Digital Signal Processing-A computer based approach, S. Mitra, TMH
4. Digital Signal Processing-implementation using DSP microprocessors with examples from TMS320C54XX, Avtar Singh & S. Srinivasan, Cengage Learning
5. Digital Signal Processing, Chen, OUP
6. Digital Signal Processing, Johnson, PHI
13. Xilinx FPGA user manual and application notes

**EC(EE) -791(b) Digital Signal Processing Lab. 0-0-3-3-2:**

Simulation Laboratory using standard Simulator:
1. Sampled sinusoidal signal, various sequences and different arithmetic operations.
2. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
3. Z-transform of various sequences – verification of the properties of Z-transform.
4. Twiddle factors – verification of the properties.
5. DFTs / IDFTs using matrix multiplication and also using commands.
7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.
8. Butterworth filter design with different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.

Hardware Laboratory using either 5416 or 6713 Processor and Xilinx FPGA:
1. Writing & execution of small programs related to arithmetic operations and convolution using Assembly Language of TMS320C
2. Writing of small programs in VHDL and downloading onto Xilinx FPGA.
3. Mapping of some DSP algorithms onto FPGA.
EC(EE) -701(c) Optical Communication & N/W  4-0-0-4-4:
Introduction to communication systems: Principles, components; Different forms of communications in brief, advantages of optical fibre communication, spectral characteristics.
Optical Fibre wave guide: Structure, Single and Multimode operation; Attenuation, Material and wave guide dispersion.
Optical Sources: Light Emitting Diode; principle, structures, powerand efficiency, coupling to fibres.
Laser diodes; principle, double heterostructure, gain and index guiding, distributed lasers.Quantum Well Lasers; Modes and narrow linewidth lasers. Modulation; Bandwidth for modulation, Optical transmitters: components.
Optical Detectors: Device types, optical detection principles, efficiency, responsivity, bandwidth. Preamplifiers; noise sources, signal to noise ratio.
Point-to-point link and Wavelength Division Multiplexing:Building blocks; Multiplexing; Intensity Modulation/Direct Detection system; Principle of Regeneration; WDM link, Optical amplifiers; EDFA, SOA, Raman amplifier, Fabry-Perot filters. Dispersion compensation and management, Link analysis and Bit-Error-Rate calculation.
Optical Network: LAN, MAN, WAN; Topologies: bus, star, ring; Ethernet; FDDI; Telecom networking:SDH/SONET. Different forms of access networks: Telephony; ISDN; Cable TV; Broadcast and Switched Networks; HFC networks; FTTC and FTTH networks; All optical networks.
Books:
1. Optical Networks – A practical perspective : Rajiv Ramaswami, K. N. Sivarajan, Galen H. Sasaki (Morgan-Kaufman)
2. Optical Fibre Communication : John M. Senior (Pearson)
3. Optical Fibre Communication : Gerd Kaiser (TMH)
4. Optical Communication Systems : John Gawar (PHI)

EC(EE) -791(c) Optical Communication & N/W  Lab.  0-0-3-3-2:
Experiment with Optical fibre:
1. To calculate attenuation constant, bending loss andnumerical aperture of optical fibre.
2. Experiments using LED module: Study of DC characteristics.
3. I-V characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.
4. P-I characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.
5. Experiment with fibre Optic analog link:
6. Input-output characteristics using long optical fibre. Calculation of attenuation per unit length of optical fibre.

EC(EE)-701(d) Digital Communication : 4-0-0-4-4:
Probability Theory and Random Processes: Conditional probability, communication example, joint probability, statistical independence, random variable-continuous and discrete, cumulative distribution function, probability density function – Gaussian, Rayleigh and Rician, mean, variance, random process, stationary and ergodic processes, correlation coefficient, covariance, auto correlation function and its properties, random binary wave, power spectral density.
Signal Vector Representation: Analogy between signal and vector, distinguishibility of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point, signal constellation, geometric interpretation of signals, likelihood functions, Schwarz inequality, Gram-Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error, error function, complementary error function, Type-I and Type-II errors
Digital Data Transmission: Concept of sampling, Pulse Amplitude Modulation (PAM), interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization, quantization noise, binary encoding, A-Law and b -law companding, differential PCM, deltamodulation and adaptive delta modulation. Digital transmission components, source, multiplexer, line coder, regenerative repeater, concept of line coding – polar/unipolar/bipolarNRZ and RZ, Manchester, differential encoding and their PSDs, pulse shaping, Inter Symbol Interference. (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction.
Digital Modulation Techniques: Types of Digital Modulation, coherent and non-coherent Binary Modulation Techniques, basic digital carrier modulation techniques: ASK, FSK and PSK, Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK. Concept of M-ary Communication, M-ary phase shift keying, the average probability of symbol error.
for coherent M-ary PSK, power spectra of MPSK, Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals, Offset Quadrature Phase Shift Keying (OQPSK), Coherent Frequency Shift Keying (FSK), Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal, Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying: GMSK, basic concept of OFDM, constellation diagram, Some performance issues for different digital modulation techniques - Error Vector Magnitude (EVM), Eye Pattern and Relative Constellation Error (RCE), Conceptual idea for Vector Signal Analyzer (VSA).

Books:
1. Digital Communications, S. Haykin, Wiley India.
3. Wireless Communication and Networks: 3G and Beyond, I. Saha Misra, TMH Education.

EC(EE)-791(d) Digital Communication Lab.: 0-0-3-3-2:
1. Design, implementation and study of all the properties of 7-length and 15-length pn sequences using shift register.
2. Study of PAM and demodulation.
3. Study of PCM and demodulation.
4. Study of line coders: polar/unipolar/bipolar NRZ, RZ and Manchester.
5. Study of delta modulator and demodulator.
7. Study of BFSK modulator and demodulator.
8. Study of ASK modulator and demodulator.
10. Simulation study of probability of symbol error for BPSK modulation.
11. Simulation study of probability of symbol error for BFSK modulation.

EE-781 Electrical Design Sessional-I 1-0-3-4-3:
Some problems to be taken up from the following jobs and some problems to be taken up in 8th semester through EE-882 Electrical Design sessional-II:
• Designing a heating element with specified wattage, voltage and ambient temperature.
• Designing an aircore grounding reactor with specified operating voltage, nominal current and fault current.
• Designing the power distribution system for a small township.
• Designing a double circuit transmission line for a given voltage level and power (MVA) transfer.
• Wiring and installation design of a multistoried residential building (G+4, not less than 16 dwelling flats with a lift and common pump)
• Wiring and installation design of an office building with lift, AC, pump etc.
• Electronic circuit design and component selection
• Power Amplifier Design
• OPAMP circuits design
• Digital design
• Wiring and installation design of a multistoried hospital building with lift, common pump, AC etc.
• Compensation design in control m system.
• Designing of a substation
• Designing an ONAN distribution transformer.
• Designing a three phase squirrel cage induction motor.
• Designing a three phase wound rotor induction motor.
• Designing a split phase squirrel cage induction motor for a ceiling fan or a domestic pump.
• Designing a permanent magnet fractional hp servo motor.
• Designing an instrumentation system.

EE-782 Industrial Training Evaluation 0-0-3-3-2:
Student has to deliver a seminar on Industrial Training conducted after 6th semester

EE-783 Project-I 0-0-3-3-2:
A preliminary/short project to be carried out after discussions with project supervisor.

8th semester:

EE-801 UTILISATION OF ELECTRIC POWER 4-0-0-4-4:
Electric Traction: Requirement of an ideal traction system, Supply system for electric traction, Train movement(speed time curve, simplified speed time curve, average speed and schedule speed), Mechanism of train movement (energy consumption, tractive effort during acceleration, tractive effort on a gradient, tractive effort for resistance, power & energy output for the driving axles, factors affecting specific energy consumption, coefficient of adhesion).

Electric traction motor & their control: Parallel and series operation of Series and Shunt motor with equal and unequal wheel diameter, effect of sudden change of in supply voltage, Temporary interruption of supply, Tractive effort and horse power. Use of AC series motor and Induction motor for traction. Traction motor control: DC series motor control, Multiple unit control, Braking of electric motors, Electrolysis by current through earth, current collection in traction system, Power electronic controllers in traction system.

Illumination: The nature of radiation, Polar curve, Law of illumination, Photometry (Photovoltaic cell, distribution photometry, integrating sphere, brightness measurement). Types of Lamps: Conventional and energy efficient, Basic principle of light control, Different lighting scheme & their design methods, Flood and Street lighting.

Electric Heating welding: Types of heating, Resistance heating, Induction heating, Arc furnace, Dielectric heating, Microwave heating.

Electrolytic processes: Basic principles, Faraday’s law of Electrolysis, Electro deposition, Extraction and refining of metals, Power supply of Electrolytic processes.

Text Books:

EE-802 (a) FACTS & HVDC Transmission 4-0-0-4-4:
Introduction: Introduction of DC power transmission technology, comparison of AC and DC transmission, limitation of HVDC transmission, reliability of HVDC systems, application of DC transmission, description of DC transmission system, planning for HVDC transmission, modern trends in DC transmission.

Analysis of HVDC converters: Choice of converter configuration, simplified analysis of Graetz circuit, converter bridge characteristics, Characteristics of a twelve pulse converter, detailed analysis of converters.

Control of HVDC converter and systems: Necessity of control of a DC link, rectifier control, compounding of rectifiers, power reversal of DC link, voltage dependent current order limit (VDCOL) characteristics of the converter, inverter extinction angle control, pulse phase control, starting and stopping of DC link, constant power control, control scheme of HVDC converters.

Harmonics and filters: Generation of harmonics by converters, characteristics of harmonics on DC side, characteristics of current harmonics, characteristic variation of harmonic currents with variation of firing angle and overlap angle, effect of control mode on harmonics, noncharacteristic harmonic. Harmonic model and equivalent circuit, use of filter, filter configuration, design of bandpass and high pass filter, protection of filters, DC filters, power line communication and RI noise, filters with voltage source converter HDVC schemes.
Fault and protection schemes in HVDC systems: Nature and types of faults, faults on AC side of the converter stations, converter faults, fault on DC side of the systems, protection against over currents and over voltages, protection of filter units.

Multiterminal HVDC systems: Types of multiterminal (MTDC) systems, parallel operation aspect of MTDC. Control of power in MTDC. Multilevel DC systems. Power upgrading and conversion of AC lines into DC lines, Parallel AC/DC systems. FACTS and FACTS converters.

Text Books:

Reference Books:

EE-802(b) Power Plant Engineering 4-0-0-4-4:
Introduction: Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion calculations. Load estimation, load curves, various terms and factors involved in power plant calculations. Effect of variable load on power plant operation, Selection of power plant.

Power plant economics and selection: Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor’s profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.

Steam power plant: General layout of steam power plant, Power plant boilers including critical and supercritical boilers. Fluidized bed boilers, boilers mountings and accessories, Different system such as coal handling system, pulverizers and coal burners, combustion system, draft, ash handling system, Dust collection system, Feed water treatment and condenser and cooling towers and cooling ponds, Turbine auxiliary systems such as governing, feed heating, reheating, flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency, Site selection of a steam power plant.

Diesel power plant: General layout, Components of Diesel power plant, Performance of diesel power plant, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance, Site selection of diesel powerplant, Comparative study of diesel power plant with steam power plant.

Gas turbine power plant: Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants, Site selection of gas turbine power plant.

Nuclear power plant: Principles of nuclear energy, Lay out of nuclear power plant, Basic components of nuclear reactions, nuclear power station, Nuclear waste disposal, Site selection of nuclear power plants. Hydroelectric station Hydrology, Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems. Non Conventional Power Plants Introduction to non-conventional power plants (Solar, wind, geothermal, tidal) etc.

Electrical system: Generators and their cooling, transformers and their cooling. Instrumentation Purpose, classification, selection and application, recorders and their use, listing of various control rooms. Pollution due to power generation.

Text Books:

Reference Books:
1. Steam & Gas Turbines & Power Plant Engineering by R. Yadav, Central Pub. House

EE-802(c) Power Generation and Economics 4-0-0-4-4:
Economics of Generation: Cost of power generation—Thermal, Hydro and Nuclear. Types of Consumers in a distribution system—Domestic, Commercial, Industrial etc. Concept of load factor, plant capacity factor, plant use factor, diversity factor, demand factor. Choice of size and number of generation units.


Unit Commitment: Constraints in Unit Commitment, Spinning reserve, Thermal unit constraints, Hydro constraints, Must run, Fuel constraints. Unit commitment solution methods.


State Estimation and load forecasting in power system:
Introduction, state estimation methods, concept of load forecasting, load forecasting technique and application in power system.

Text Books:
2. Power system Analysis, operation & control, Chakrabarty & Haldar, 2nd edition, PHI.

References:
1. Power generation operation & control, A.J. Wood & B.F. Wollenberg, Wiley India.
2. Operation and control in power system, P.S.R. Murthy, BSP Publication.

EE-802(d) Power System Dynamics & Control 4-0-0-4-4:

Reactive Power Flow and Voltage Control Problems: Reactive power-voltage coupling concept, reactive power and voltage regulation, load bus reactive power sensitivity, effect of series reactive loss, reactive power requirement for control of voltage in long lines, concept of voltage stability and system voltage expression, stability margins, fundamental aspects of analysis of power system voltage stability—static and dynamic analysis, QV operation of on load tap changer in voltage stability, load flow and voltage stability, voltage security, magnitude and power angle of receiving end bus voltage at voltage stability limit.

Power System Compensation and FACTs Devices: Load compensation, line compensation, passive compensation—static shunt capacitor and reactor, uniformly distributed shunt compensation, shunt compensation at middle of the line using dynamic compensator, series capacitor compensator, comparison between shunt and series compensation, FACTs controllers, (series type, shunt type, combined shunt and series type FACTs controller), advantages of FACTs devices.

Small Signal Stability and Subsynchronous Resonance: Introduction, stability of a dynamic system, modes of oscillation, mechanism of tie line oscillator, small signal stability of a single machine on infinite bus (SMIB), modeling of small signal stability, effect of exciter on small signal stability, SSR in series compensated systems, modeling and analysis of mechanical system and analogy with electrical system, countermeasures to SSR.

Books
1. Power system analysis, operation and control. A.Chakrabarti and S. Halder, PHI publication, (3rd Edn.)
2. Power system dynamics, stability and control. K.R. Padiyar, BS publication. (2nd Edn.)
3. Reactive power control and voltage stability of EHV power transmission system. A. Chakrabarti, D.P Kothari,. A.K Mukhapadhyay and A.De, PHI publication.(1st Edn.)

EE-803(e) AI and Soft Computing 4-0-0-4-4:

**Knowledge representation:** First order logic – representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic – prepositional versus first order logic – unification and lifting – forward chaining – backward chaining - Resolution - Knowledge representation - Ontological Engineering - Categories and objects – Actions - Simulation and events - Mental events and mental objects.


**Text Books:**

**Reference Books:**

**EE-803 (f) Advanced Electric Drives 4-0-0-4-4:**
Introduction: Classification of Electric Drives, Requirements of Electric Drives, Some Applications Converters and control: Phase controlled converters, Four quadrant operation, Choppers, AC to DC converters. DC motor drives: Speed-torque characteristics DC shunt, PMDC and series motors, Dynamic model, Speed and position control methods Inverters and PWM techniques: voltage source inverters, current source inverters, PWM techniques - sine-triangle comparison, harmonic elimination, hysteresis current controllers, space vector pwm. AC motor drives: d-q model of induction motor, constant flux speed control structure, vector control model, vector control structure.

**Text Books:**
2. Electric Drives, Vedam Subrahmanyam, TMH

**Reference Books:**
1. Electric motor drives, R. Krishnan, PHI

**EC(EE)-801(a) Digital Image Processing Systems: 4-0-0-4-4:**
Introduction to structure of human eye, Image formation in the human eye, Brightness adaptation and discrimination, Image sensing and acquisition, storage, Processing, Communication, Display Image Sampling and quantization, Basic relationships between pixels.


Morphological Image Processing: Introductions, Dilatation, Erosion, Opening, closing, Hit-or-miss transformation, Morphological algorithm operations on binary Images, Morphological algorithm operations on gray-scale Images. Image Segmentation, Representation and Description: Detection of discontinuities, Edge linking and Boundary detection, Thresholding region based segmentation, Image Representation schemes, Boundary descriptors, and Regional descriptors.

Text Books:

Reference Books:

EC(EE)-801(b) Communication Engineering : 4-0-0-4-4:

Elements of communication system: The elements of a communication system, origin of noise and its effect, importance of SNR in system design. Basic principle of linear (AM) modulation, Generation of AM waves, Demodulation of AM waves. Basic principle of nonlinear (FM, PM) modulation. Generation of FM waves, Demodulation of FM waves. Sampling theorem, sampling rate, impulse sampling, reconstruction from samples, Aliasing. Analog pulse modulation-PAM (natural & flat topped sampling), PWM, PPM. Basic concept of Pulse code modulation, Block diagram of PCM, Multiplexing-TDM, FDM.

Digital transmission: Concept of Quantization & Quantization error, Uniform quantizer, Non-uniform quantizer, A-law and μ-law. Encoding, coding efficiency. Line coding & properties, NRZ & RZ, AMI, Manchester coding, PCM, DPCM. Base band pulse transmission, Matched filter, error rate due to noise, ISI, Raised cosine function, Nyquist criterion for distortion-less baseband binary transmission, Eye pattern, Signal power in binary digital signal.

Digital carrier modulation & demodulation technique: Bit rate, Baud rate, Information capacity, Shannon’s limit, M-ary encoding, Introduction to the different digital modulation techniques-ASK, FSK, PSK, QPSK, 8PSK, 16 BPSK. Introduction to QAM, basic of 8 QAM, 16 QAM. Basic concept of Delta modulating, Adaptive delta modulation. Introduction to the concept DPCM. Basic concept of spread spectrum modulation.


Text Books:
1. An Introduction to Analog and Digital communication, Simon Haykin, Wiley India.
2. Analog communication system, P. Chakrabarti, Dhanpat Rai & Co.

Reference Books:

EC(EE)-801(c) VLSI & MICROELECTRONICS 4-0-0-4-4:

Introduction to VLSI Design: VLSI Design Concepts, Moor’s Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical), Y-Chart, Digital VLSI Design Steps.


Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator Layout Design Rule: Stick diagram with examples, Layout rules.

Hardware Description Language – VHDL or Verilog Combinational & Sequential Logic circuit Design.

Text Books:
2. CMOS Digital Integrated Circuit, S.M.Kang & Y.Leblebici, TMH.
4. VHDL, Bhaskar, PHI.
5. Advance Digital Design Using Verilog, Michel D. Celliti, PHI

References:
2. Modern VLSI Design: system on silicon, Wayne Wolf; Addison Wesley Longman Publisher

EC(EE) -801(d) Embedded System 4-0-0-4-4:

Microcontroller: characteristics and Features, Overview and architectures of Atmel 89C52 and Microchip PIC16F877 and 18F452.


Software architecture and RTOS: Software Architecture: Round Robin- Round Robin with interrupts -Function Queue. Scheduling

Architecture RTOS: Architecture -Tasks and Task States -Tasks and Data - Semaphores and Shared Data - Message Queues -Mail Boxes and pipes -Timer Functions -Events -Memory Management, Interrupt , Routines

Basic design using a real time operating system: Overview. General principles. Design of an embedded system.


Text Books:

Reference Books:
EC(EE)-801(e) Satellite Communication and Remote Sensing : 4-0-0-4-4:

Historical background, Basic concepts, Frequency allocation for satellite services, orbital & spacecraft problems, comparison of networks and services, modulation techniques used for satellite communication.

Orbits- Two body problem, orbital mechanics, geostationary orbit, change in longitude, orbital maneuvers, orbital transfer, orbital perturbations.

Launch Vehicles- principles of Rocket propulsion, powered flight, Launch vehicles for communication satellite.

RF link- noise, the basic RF link, satellite links (up and down), optimization RF link, intersatellite link, noise temperature, Antenna temperature, overall system temperature, propagation factors, rain attenuation model. Tropospheric and Ionospheric EFFECT.

Multiple access- FDMA, TDMA, CDMA techniques, comparison of multiple access techniques, error connecting codes.

Satellite subsystems and satellite link design- AOCS, TT&C, power system, spacecraft antenna, transponder, Friis transmission equation, G/T ratio of earth station.

Remote Sensing: Basic of remote sensing, Electromagnetic Radiation principles, Atmospheric window, Indian satellitesensing satellite system, Active, Passive, ground based and space based remote sensing. Spatial, spectral, Radiometric and temporal resolution, satellite sensors, detectors and scanning technique, FOV and error sources, Image analysis and Interpretation weather RADAR, LIDAR, acoustic sounding systems, TRMM, AURA-MLS, Megha Tropiques

Altimeter , Scatterometer, Radiometer.

Ground based and radio occultation techniques, spectral response of water, Sea surface temperature, wind speed, colour monitor, clouds and aerosols, water vapor, convective system, Trace gases.

Ref.:
1. Remote Sensing and GIS - B. Bhatta (oxford university press)
4. Satellite communication – D. Roddy (TMH)

EE- 881 Project-II 0-0-6-6-4:

A final / detailed project to be completed, a Thesis on that topic to be submitted and to be appeared in a seminar to defend the submitted final project.

EE- 882 Electrical Design Sessional -II 0-0-6-6-4:

Some problems to be taken up from the following jobs and some problems already taken up in 7th semester through EE-781 Electrical Design-I to be left out from the list:

- Designing a heating element with specified wattage, voltage and ambient temperature.
- Designing an aircore grounding reactor with specified operating voltage, nominal current and fault current.
- Designing the power distribution system for a small township.
- Designing a double circuit transmission line for a given voltage level and power (MVA) transfer.
- Wiring and installation design of a multistoried residential building (G+4,not less than 16 dwelling flats with a lift and common pump)
- Wiring and installation design of an office building with lift, AC, pump etc.
- Electronic circuit design and component selection
- Power Amplifier Design
- OPAMP circuits design
- Digital design
- Wiring and installation design of a multistoried hospital building with lift, common pump, AC etc.
- Compensation design in control m system.
- Designing of a substation
• Designing distribution transformer.
• Designing a three phase squirrel cage induction motor.
• Designing a three phase wound rotor induction motor.
• Designing a split phase squirrel cage induction motor for a ceiling fan or a domestic pump.
• Designing a permanent magnet fractional hp servo motor.
• Designing an instrumentation system.
• To be added more in light of technological advancement.

EE-883 Grand Viva 0-0-0-0-4:
Each student has to appear for final viva.