

Academic Scheme

for

B.Tech Electrical Engineering

Four Years Programme

Syllabus

(I – VIII Semesters)

(For Batches 2013 & 2014)

Vetted in BOS 2013



**Department of Electrical Engineering
IUST, Awantipora, Pulwama -192122**

Department of Electrical Engineering

1st Semester

Course Code	Course Title	L – P	Credit
EE 101T	Computer Fundamentals & Programming	4 – 0	4
EE 102T	Physics-I	4 – 0	4
EE 103T	Chemistry-I	4 – 0	4
EE 104T	Mathematics-I	4 – 0	4
EE 105T/P	Engineering Drawing	2 – 3	4
EE 106P	Computer Fundamental & Programming Lab	0 – 2	1
EE 107P	Physics-I Lab	0 – 2	1
EE 108P	Chemistry –I Lab	0 – 2	1
EE 109P	Engineering Workshop	0 – 3	2
	Total Credits	18 - 12	25

2nd Semester

Course Code	Course Title	L – P	Credit
EE 201T	Physics-II	4 – 0	4
EE 202T	Chemistry-II	4 – 0	4
EE 203T	Mathematics-II	4 – 0	4
EE 204T	Professional Communication and Moral Ethics	4 – 0	4
EE 205T	Engineering Mechanics	4 – 0	4
EE 206T/P	Machine Drawing	3 – 2	4
EE 207P	Computer Programming Lab	0 – 3	2
EE 208P	Physics-II Lab	0 – 2	1
EE 209P	Chemistry-II Lab	0 – 2	1
	Total Credits	23– 9	28

Department of Electrical Engineering

3rd Semester

Course Code	Course Title	L – P	Credit
EE 301T	Basics of Electronics	3 – 0	3
EE 302T	Network Analysis	3 – 0	3
EE 303T	Basic Electrical Engineering	4 – 0	4
EE 304T	Electrical Engineering Materials	3 – 0	3
EE 305T	Electromagnetic Fields and Waves	3 – 0	3
EE 306T	Mathematics-III	4 – 0	4
EE 307T	Basic Mechanical Engineering	3 – 0	3
EE 308P	Basics of Electronics Lab	0 – 2	1
EE 309P	Basic Electrical Engineering Lab	0 – 3	2
EE 310P	Introduction to MATLAB	0 – 2	1
	Total Credits	23 – 7	27

4th Semester

Course Code	Course Title	L – P	Credit
EE 401T	Electrical Machines-I	4 – 0	4
EE 402T	Digital Electronics & Logic Design	3 – 0	3
EE 403T	Control Systems-I	4 – 0	4
EE 404T	Electronic Devices & circuits	3 – 0	3
EE 405T	Mathematics-IV	4 – 0	4
EE 406T	Hydraulics and Hydraulic Machines	3 – 0	3
EE 407P	Electrical Machines-I Lab.	0 – 3	2
EE 408P	Digital Electronics & Logic Design Lab	0 – 3	2
EE 409P	Control System Lab	0 – 2	1
EE 410P	Electronic Devices & circuits Lab	0 – 2	1
	Total Credits	21 - 10	27

5th Semester

Course Code	Course Title	L – P	Credit
EE 501T	Electrical Machines-II	4 – 0	4
EE 502T	Electrical Measurements & Instrumentation	4 – 0	4
EE 503T	Microprocessors	3 – 0	3
EE 504T	Communication Systems	3 – 0	3
EE 505T	Mathematics-V	4 – 0	4
EE 506P	Electrical Machines-II Lab	0 – 3	2
EE 507P	Electrical Measurements & Instrumentation Lab	0 – 3	2
EE 508P	Microprocessors Lab	0 – 3	2
	Total Credits	18 – 9	24

6th Semester

Course Code	Course Title	L – P	Credit
EE 601T	Power Systems-I	4 – 0	4
EE 602T	Power Electronics	4 – 0	4
EE 603T	Digital Signal Processing	4 – 0	4
EE 604T	Control System-II	3 – 0	3
EE 605T	Design of Power Apparatus	4 – 0	4
EE 606P	Power System-I Lab	0 – 3	2
EE 607P	Power Electronics Lab	0 – 3	2
EE 608P	Control System-II Lab	0 – 3	2
	Total Credits	19 - 9	25

7thSemester

Course Code	Course Title	L – P	Credit
EE 701T	Power System-II	4 – 0	4
EE 702T	Power System Protection	3 – 0	3
EE 703T	Microcontroller & Applications	4 – 0	4
EE 704T	Industrial Management	3 – 0	3
EE 705T	Electrical Drives	3 – 0	3
EE 706P	Power System-II Lab	0 – 2	1
EE 707P	Power System Protection Lab	0 – 2	1
EE 708P	Electrical Drives Lab	0 – 2	1
EE 709P	Preliminary Project Work/ Seminar	0 – 4	2
EE 710P	Practical Training		2
DIC E01P	Microcontroller based system Design (Optional)	0 - 6	3
	Total Credits	17 - 10	24 + 3

8thSemester

Course Code	Course Title	L – P	Credit
EE 801T	Advanced Power Electronics	4 – 0	4
EE 802T	Power Station Practice	4 – 0	4
EE 803TE	Elective-I	4 – 0	4
EE 804TE	Elective-II	4 – 0	4
EE 805P	Project	0 – 18	12
	Total Credits	16- 18	28

List of Electives
Power Systems Transients
EHV AC & DC Transmission
Flexible AC Transmission Systems
Stand Alone Power System
Optimization Techniques
High Voltage Engineering
Selected Topics in Advanced Control
Optimal Control
Advanced Electrical Drives
Fuzzy Logic & Neural Networks
Industrial Process Control

Semester-I

Course Code	Course Title	L – P	Credit
EE 101T	Computer Fundamentals & Programming	4 – 0	4
EE 102T	Physics-I	4 – 0	4
EE 103T	Chemistry-I	4 – 0	4
EE 104T	Mathematics-I	4 – 0	4
EE 105T/P	Engineering Drawing	2 – 3	4
EE 106P	Computer Fundamental & Programming Lab	0 – 2	1
EE 107P	Physics-I Lab	0 – 2	1
EE 108P	Chemistry –I Lab	0 – 2	1
EE 109P	Engineering Workshop	0 – 3	2
	Total Credits	18 - 12	25

EE -101T- Computer Fundamentals and Programming

L – P

4 – 0

Unit-I

Computer Fundamentals: Computer components, characteristics& classification of computers, hardware& software, peripheral devices, system software, application software, compiler, interpreter, utility program, : Assemblers, Interpreters, Compilers.

Logic Circuits & Computer Architecture, Switching circuits, AND, OR, NOT operations. Interconnection of units, processor to memory communication etc, Bus architecture, virtual memory.

Data Representation: Representation of characters, Integers, fractions. Hexadecimal representation of numbers, decimal –to- binary conversion. Binary Arithmetic, Binary addition, subtraction, two's complement, representation of numbers, addition/ subtraction of numbers in two's complement, binary multiplication and division

Unit-II

Microsoft Windows- An overview of different versions of Windows, Basic Windows elements, File management through Windows. Using essential accessories: System tools – Disk cleanup, Disk defragmenter. Command Prompt- Directory navigation, path setting, creating and using batch files. Drives, files, directories, directory structure. Application Management: Installing, uninstalling, Running applications. Linux- An overview of Linux, Basic Linux elements: System Features, Software Features, File Structure, File handling in Linux: H/W,S/W requirements, Preliminary steps before installation, specifics on Hard drive repartitioning and booting a Linux system. Basic shell commands.

Unit-III

Programming Language Classification & Methodology: Introduction to Computer Languages, Generation of Languages, Flow Charts, Dataflow Diagram Translators

Introduction to C Programming: Engineering problem solving methodology, computer languages, History of C, High-level languages, A simple C Program.

C-Programs: Program structure, constants and variables, scientific notation, memory concepts, Assignment statements.

Steps in Programming: Numeric data types, symbolic constants, arithmetic operators, priority of operators, Mathematical functions.

Unit IV

Making Decisions: The decision making process, Arithmetic comparisons, logical expressions, Algorithms, Pseudo-code, control structures. *If* Selection structure, *if/else* Selection structure, *while* repetition structure, formulating Algorithms, Assignment operators, Nested *If* statements.

C Program Control: Essentials of Repetition, Counter-Controlled Repetition, *for* repetition structure, *for* structure, *Switch* multiple-selection structure. *Do/while* repetition structure, *break* and *continue* statements, logical operators.

Unit-V

Functions: Program modules, Math library functions, Functions, Function definition and prototypes, header files, calling functions, random number generation, recursion.

Arrays and Matrices: Programs without arrays, using arrays, arrays and addresses, multi-dimensional arrays, storing arrays, searching arrays

Books Recommended

1. Fundamentals of Computers, V. Rajaraman, Prentice-Hall, 2006 edition.
2. Introduction to computers, Peter Norton, Tata McGraw Hill, Sixth Edition.

EE -102T- Physics-I

L – P

4 – 0

Unit-I

Vector Analysis, Rotation of coordinate axis and transformation of vectors, Gradient of scalar field, divergence and curl of vector field in Cartesians, spherical polar and cylindrical coordinate systems, Gauss's divergence theorem, Stokes's theorem

Unit-II

Collision of particles, Conservative and non-conservative forces, elastics and inelastic scattering, frames of references, laboratory and center of mass system, kinematics of elastics scattering in laboratory system, application of conservation theorem in solving collision and scattering problems.

Unit-III

Vibration and Acoustics, Differential equation of simple harmonic motion, energy of simple harmonic oscillator, damped harmonic motion, energy dissipation, forced oscillations, amplitude and velocity resonance, sharpness of resonance, energy consideration in forced oscillations

Unit-IV

Electromagnetic Theory: Coulombs law and Gauss's theorem, calculation of electric field and potential, Biot -Savart's law, Ampere's theorem, divergence and curl of magnetic field, Faraday's law,

Unit-V

Maxwell's equation, electromagnetic wave equation in free space, its solution in one dimension and discussion, energy and momentum in electromagnetic wave, Introduction to plasma: Debye shielding, plasma parameter, plasma frequency

Books Recommended

1. Introduction to classical Mechanics by R.G.Takwale and P.S Puranik (Tata McGraw Hill publishing Co.)
2. Classical Mechanics by N.C. Rana and P.S. Jog (Tata McGraw Hills)
3. Introduction to Electrodynamics By David Griffiths (Pearson Education)
4. Introduction to Plasma theory by Dwight R. Nicholson (John Wiley)
5. Vibrations and Waves by A.P French, 1996

EE -103T- Chemistry -I

L – P

4 – 0

Unit-I Chemical Thermodynamics

Introduction and Importance, Concept of Heat and Work, State Functions and Path Functions. First Law of Thermodynamics, Work done in Isothermal and Adiabatic Conditions. Heat capacities, Relation between C_p and C_v relations, Second Law of Thermodynamics, Concept of Entropy, Gibbs free energy. Free Energy Changes as Criteria of Reversible and Irreversible process, Gibbs-Helmholtz's equation, Clausius- Clapeyron equation.

Unit-II Electrochemistry

Introduction, Conductivity of Electrolytes, Kohlrausch's Law of Independent Migration of Ions and its Application, Debye Huckel Theory of Strong Electrolytes. Electrochemical cells, Electrode-Potential, Standard Electrode Potential, Types of Electrodes (Metal-Metal Ion electrode, Gas Electrodes, Metal Insoluble Metal Salt Electrode), Fuel Cells, Hybrid cells, pH: Measurement and Control

Unit-III General Organic Chemistry

Introduction, Electronic Displacements in Organic Molecules, Reaction Intermediates, Types of Organic reaction (Addition, Elimination, Substitution, and Rearrangements Reaction). Isomerism: Structural Isomerism, Geometrical isomerism, E/Z system of Nomenclature, Chirality, Optical isomerism, Optical Activity without Chirality

Unit-IV Alloys

Introduction To Alloys, Advantages of Alloys over other Metallic Materials, Manufacturing of Alloys (Fusion Method, Powder Metallurgy, Electrodeposition and Reduction method), Classification of Alloys (Ferrous and non-Ferrous metal Alloys), Carbon steels (Carbon Steels Classification, Composition and Uses), Alloy Steels (Low, Medium and High alloys steels), Effect of Different Alloying Elements on Properties of Alloy steels, Engineering Application of Copper, Nickel and Aluminum Alloys

Unit-V Instrumental Techniques

Introduction, Advantages and Disadvantages of Instrumental and Non-Instrumental Methods, Electromagnetic Radiation, Electromagnetic Spectrum, Light Absorption (Beers-Lambert Law) Infrared Spectroscopy (Modes of vibration, IR bands corresponding to different functional groups and Applications), UV-VIS spectroscopy (Types of Transition, Chromophors, Auxo-chromes and Applications)

Books Recommended:

J.C. Kuriacose and J. Rejaraman: Chemistry in Engineering and Technology Volumes I & II (Tata McGraw Hill publishing company Limited, New Delhi)

P.C. Jain. Engineering Chemistry, (Dhanpat Rai & Sons, Nai Sarak; New Delhi).

Physical Chemistry – Puri Sharma and Patharua.

Inorganic Chemistry (J.D. Lee).

Physical Chemistry by Peter Atkins, Julio depaula

Electrochemistry and Corrosion Science by N.Perez

A Textbook of Organic Chemistry, V. K. Ahluwalia and Madhuri Goyal

EE -104T- Mathematics-I

L – P

4 – 0

Unit-I

Introduction to differential calculus, Leibnitz's Theorem for n^{th} derivative, Taylor's theorem, Tangent and Normal, Partial Differentiation, Euler's theorem, Double points, asymptotes, curvature and tracing of curves.

Unit-II

Limit, continuity and differentiability of functions of several variables, chain rule, Jacobi theorem. Taylor's theorem of one and two variables, extrema of functions, two or more variables using method of Lagrange's multipliers

Unit-III

Ordinary differential equations: Exact ordinary differential Equations and Ordinary differential equations reducible to exact differential equations. Linear differential equations and equations reducible to linear form. Linear Differential Equations of second and higher order with constant and variable coefficients.

Unit-IV

Non-linear differential equation of first order, Simultaneous differential equation of the form $dx/P = dy/Q = dz/R$, Applications of ordinary differential equations,

Unit-V

Algebraic Equation, Elements of the theory of polynomial equations. Fundamental theorem of Algebra, Relation between the roots and the coefficients of an equation, Solution of cubic & bi-quadratic equations

Books Recommended

1. Differential calculus, Shanti Narayan, S.Chand
2. A text Book on Engineering Mathematics by Bali, N.P, Luxmi Publications
3. Ordinary and Partial Differential equation, M.D.Raisinghania, S.Chand and Co

Reference Books

1. Advanced Engineering Mathematics by Jain, R.K. and Iyengar SRK, Narosa, 2001
2. Advanced Engineering Mathematics, Kreyszig, J.Wiley
3. Linear Algebra, Hoffmann & Kunze, Prentice-Hall
4. Differential equations and its applications, H.T.Piaggio, Prentice-Hall
5. Engineering mathematics Vol I-II, Sastry, Prentice Hall of India

EE -105T/P- Engineering Drawing

L-P

2-3

UNIT- I:

Basic Concepts of drawing quadrants, drawing instruments, types of lines etc.

Dimensioning: General rules of dimensioning. Types: Aligned, unidirectional, chain, parallel, combined, title, block & margins.

Orthographic projections: Concept of horizontal and vertical planes, first and third angle projections, orthographic projections of simple blocks, missing lines and missing views.

Projection of points, lines and planes: Projection of points in different quadrants, projection of lines and planes positioned in different orientations with respect to the principle planes.

UNIT II

Projection of solids: Projection of simple geometrical solids placed in simple positions and with single rotations of the face, edge or axis of the solid with respect to one of the principal planes of projection.

UNIT III

Section of solids: Principal of sectioning, Section of simple geometrical solids, types of the section planes and their trace representation and location, true shape sections, sectioning by auxiliary planes.

UNIT IV

Development of surfaces: Development of surfaces of simple sectional solids and intersecting solids, transition pieces, cones & cylinders.

UNIT V

Isometric projections: Classification of pictorial projections, Isometric projection of plane figures, prisms, pyramids, cylinders and for the given orthographic projections. Introduction to Auto CADD. Basic commands of CADD.

Books Recommended :

1. Gill, P.S Engineering Drawing, S.K. Kataria and sons,
2. Bhatt, N.D Engineering Drawing, Charotar Book Stall, TulsiSadan, Anand
3. James, D Bethune Engineering Graphics with Auto CADD, 2006.
4. Narayana, Kannaiya Engineering Drawing, Scitech Publications, Chennai

Reference Books

1. Sham Tickoo, Auto CADD 2006
2. B.C.RanaM.B.Shah Engineering Drawing, Pearson Education

EE -106P - Computer Fundamental & Programming Lab

L – P

0–2

1. Familiarization with DOS environment and its important commands
2. Learning some configuration commands & creating batch files in DOS environment
3. Understanding network sharing and working with Windows utilities
4. An Introduction to Linux
5. Working with MS Office 2010
6. Learning basics of Microsoft Word
7. Exploring the advanced features of Microsoft Word
8. Working with Microsoft Excel
9. Familiarization with the environment of Microsoft Power Point
10. Creating databases using Microsoft Access
11. Creating queries, forms and reports in Microsoft Access
12. Creating a hard copy of the crucial CMOS boot configuration and restoring CMOS boot configuration when lost

13. Experimenting with the AND, OR, NAND, NOR, XOR and NOT Integrated circuits
14. Finding expression for the given logic diagram, implementing the circuit on breadboard, and observing output for various combinations of inputs
15. Demonstrating various components of a PC and their interconnection
16. Internet Basics and Networks Media
17. Internet basics
18. Familiarization with various network cables and their accessories
19. Program to print "Hello World".
20. Program to add, subtract, multiply, divide and find remainder between two numbers.
21. Program to check whether three numbers are equal or find the largest and smallest of the three using if-else.
22. Develop a menu-based calculator using switch.
23. Program to generate odd, even, fibnoccii, lucas and other common series using loops.
24. Program to develop a menu-based grade card using do-while and use continue and break statements.
25. Write functions for finding sum, difference, product and remainder between two numbers and return the result.
26. Write a function to find factorial using recursion.
27. Programs to find minimum, maximum of an array.
28. Program to implement linear search and selection sort.
29. Program to add and multiply two matrices.
30. Program to find transpose of a matrix.

EE -107P - Physics-I Lab

L - P

0 - 2

List of Experiments

1. To determine the value of e/m of electron
2. To study the bar pendulum
3. To study the Kater's reversible pendulum
4. To study the bending of beam apparatus
5. To study the Newton's ring apparatus
6. To determine the wavelength of light using a spectrometer
7. To study a Polarizer and analyzer
8. Stephens constant using incandescent lamps
9. Energy band of a semi-conductor diode

Recommended Books:

1. Practical Physics by SL Gupta,
2. Advanced Practical Physics, SP Singh, Pragati Prakashan

EE -108P - Chemistry-I Lab

L - P

0 - 2

List of Experiments

Basic Introduction on Solution Preparation, Concentration terms, Handling of Glass wares Chemicals and Instruments, Precautions

1. Determination of strength of NaOH solution by standardization of sodium hydroxide using Oxalic acid
2. To determine the acid value of a given mineral oil or vegetable oil.
3. To determine the moisture content of a given sample of coal.
4. To determine the Degree of dissociation of a weak acid by Conductometry
5. To determine the ash content of a given sample of coal.
6. Determination of the strength and pK_a value of the weak acid by titration with an alkali.
7. Estimation of calcium in Lime stone
8. To determine the Aniline point of the given sample of a Lubricating oil
9. To determine the flash and fire point of given oil by Pensky-Martins flash point apparatus.

Demonstration Experiments

1. Determination of pH of different concentration of acid and bases by pH meter
2. Determination of calorific value of solid fuels using Bomb Calorimetry

EE -109P- Engineering Workshop

L – P

0 – 3

1. **WOOD AND WOOD WORKING (CARPENTRY):** Various types of wood, defects in timber, seasoning of wood, carpentry tools and measuring devices. Common safety in wood working. Exercises on carpentry processes like marking, sawing, planning, and chiseling. Exercise for wood working joints, like Halved joints, Dovetail joints, Mortoise and Tenon joints.
2. **MACHINE SHOP:** Introduction to Machine tools, like lathes, shapers, drilling machines, sawing machines, grinding machines & milling machine with their uses; principal parts and accessories. Types of cutting tools, materials. Simple and basic metal removal operations on machines such as lathes, milling machine, shaper, grinder & drilling machines using mild steel. Safety precautions of machine tools. Introduction to CNC lathe.
3. **WELDING SHOP:** Introduction to welding applications & methods, welding equipments & electrodes. Edge preparation and simple arc- welding operations on M.S for joints like lap, butt, corner, edge & T-joint. Safety measures. Welding defects.
4. **FITTING SHOP:** Description of fitting and cutting tools like clamping tools i e vices, measuring & marking tools, calipers, vernier calipers, micrometers, dial indicators, gauges, hacksaw, files, striking tools, chisels, drills, taps, reamers, Die & die stock. Demonstration of above tools through simple operations on M.S pieces.
5. **BLACK SMITHY SHOP:** Description of supporting, holding, striking, cutting & forming/finishing tools. Heating devices and measuring tools. Simple hand forging operations like drawing down, cutting, jumping and bending. Safety precautions.
6. **FOUNDRY SHOP:** Description of foundry tools & equipments like, hand tools, moulding boxes (flasks), moulding machines, simple melting and pouring (ladles) equipments. Introduction to moulding, moulding sands, types of moulds & cores . Making of simple sand mould with core and casting.
7. **SHEET METAL SHOP :** Demonstration of Sheet metal tools for measuring, working tools like scribes, punches, chisels, snips, hammers, stakes & holders, pliers, groovers, folding bars & gauges. Simple operations like measuring & marking, lying out, cutting, shearing, bending stretch forming, riveting. Lancing, notching. Introduction to hems and seam.

Books recommended

1. Raghuvanshi , B.S; A course in workshop technology, Vol I -II. Dhanpat Rai and Sons
2. Garg S.K Workshop Technology (Manufacturing Processes) Laxmi Publications (P) LTD.
3. Hajira chowdry, Workshop Practice
4. Singh, S; Manufacturing Practice, S.K. Kataria and Sons , New Delhi

B-Tech Electrical Engineering

Semester-II

Course Code	Course Title	L – P	Credit
EE 201T	Physics-II	4 – 0	4
EE 202T	Chemistry-II	4 – 0	4
EE 203T	Mathematics-II	4 – 0	4
EE 204T	Professional Communication and Moral Ethics	4 – 0	4
EE 205T	Engineering Mechanics	4 – 0	4
EE 206T/P	Machine Drawing	3 – 2	4
EE 207P	Computer Programming Lab	0 – 3	2
EE 208P	Physics-II Lab	0 – 2	1
EE 209P	Chemistry-II Lab	0 – 2	1
	Total Credits	23– 9	28

EE - 201T – Physics - II

L – P

4 – 0

Unit-I

Quantum Mechanics: De-Broglie Hypothesis, Davison Germer experiment, wave function and its properties, expectation value, quantum mechanical operator, Wave Packet, Normalisation factor, Uncertainty principle. Schrodinger Equation for free Particle, Schrodinger wave Equation; Time Dependent and Time Independent, Tunnelling effect and its example (Tunnel diode or alpha decay).

Unit-II

Elementary Solid State Physics: Crystal lattice, Crystal structure, Unit cells, Miller Indices, Bravais lattice, Photographic crystal X-ray diffraction techniques.

Classification of solids, formation of energy bands in metals, semiconductors and insulators, intrinsic and extrinsic semiconductors, Fermi energy.

Unit-III

Diffraction: Optical diffraction techniques- Fresnel and Fraunhofer diffraction.

X-ray diffraction techniques (Single crystal and Polycrystalline materials)- Laue's method, Powder method, Oscillation and Rotation method.

Unit-IV

Special theory of Relativity: Frames of reference, Michelson-Morley experiment, Basic postulates of special theory of relativity, Length contraction, time dilatation, Time-energy relation.

Superconductivity: Meissner Effect, Type I and Type II Superconductors, BCS theory (Qualitative only), applications of superconductors

Unit-V

Lasers: Introduction, Principle of laser, Stimulated and spontaneous emission, Population inversion, Einstein coefficients, optical pumping, **Resonant Cavity and its modes**, He-Ne Laser, Ruby Laser, Semiconductor Lasers, Applications of Lasers.

Books recommended:

- A. Ghatak, "Optics"
- N. Subrahmanyam and Brij Lal, "Optics"
- Jenkins and White, "Fundamentals of Optics"
- Rajnikant, "Applied Solid State Physics"

EE - 202T – Chemistry - II

L – P

4 – 0

Unit-I NANO-TECHNOLOGY

Nanoscale and Its Significance, Properties at Nanoscale (Optical, Electrical and Magnetic). Nanostructures (Nano-rods, Nano-rings, Nano-particles), General Methods of Preparation, Carbon Nanotubes, Nanoelectrodes, Nonopolymers

Unit-II CORROSION

Introduction, Effects of Corrosion, Factors Effecting the Rate of Corrosion (Nature of the Metal and Nature of the Environment), Electrochemical Theory of Corrosion, Dry Corrosion and Wet Corrosion, Types of Corrosion (Pitting Corrosion, Crevice Corrosion, Galvanic Corrosion and Stress corrosion), Testing and Measurement of Corrosion, Corrosion Protection and Inhibition, Cathodic Protection, Anodic Protection, Protective Coatings

Unit-III POLYMERS

Advantages of Polymers over other Engineering Materials, Functionality, Degree of Polymerization, Concept of Molecular Weight, Polymerization (Addition, Condensation and Copolymerization), Polymerization Techniques (Bulk, Solution, Suspension and Emulsion polymerizations), Preparation, Properties and Engineering application of some Important Polymers, Polythene (LDPE and HDPE), Polyvinyl Chloride, Polystyrene, Teflon, Phenol Formaldehyde. Introduction to polymeric composites

Unit-IV LUBRICANTS

Introduction, Theories of Lubrication, Mechanism of Lubrication, Classification of Lubricants (Solid, Semi-Solid, liquid), Properties of Lubricants and Their Significance, Additives for Lubricants, Selection of Lubricants

Unit-V INSTRUMENTAL TECHNIQUES II

X-ray Spectroscopy: Principle and Applications

Nuclear Magnetic Resonance: Chemical Shift, Splitting and Application

Thermal Analysis: Principle, Working and Application

Basic introduction to SEM and TEM

Books Recommended:

- S.S Dara A Text Book of Engineering S Chand & Co limited New Delhi
- Advanced Practical Physical Chemistry by Yadav, Goyal publication
- Spectroscopic methods : Williams and Fleming
- Applied Chemistry : Theory And Practice By O. P. Vermani
- A Text book of Engineering Chemistry by S.S. Dara, S.Chand & Co, New Delhi
- Laboratory Manual on Engineering Chemistry by S.K. Bhasin and Sudha Rani, Dhanpat Rai Publishing Company, New Delhi (2004).
- Applied chemistry, Balsaraf V. M. Et. Al., I. K. International Publishing House Pvt. Ltd (2010)
- Electrochemistry and Corrosion Science by N.Perez

EE - 203T - Mathematics - II

L – P

4 – 0

Unit-I

Differential Equation: Partial differential equations of first order , langrage linear equation Standard form, Charpit's method to solve non linear partial differential equation,

Unit-II

Partial differential equation of second and higher order, Homogenous partial differential equations with constant coefficients, vibration of stretched flexible string, heat flow equation. Wave equation, solutions by the method of separation of variables. Series solutions of ordinary differential equations

Unit-III

Fourier Series : Fourier Series, Integral Calculus: Differential under the sign of integration. Double and triple integrals, change of variables, Beta and Gamma functions

Unit-IV

Matrices: Review of algebra of matrices, partitioning of Matrices, Hermitian and skew-Hermitian Matrices. Orthogonal and unitary matrices, Triangular matrices, Rank of a matrix. Equivalent matrices, elementary transformations, Normal form

Unit-V

Inverse of matrix(Differential Methods) and solution of simultaneous equation by elementary operation. Normal form, Eigen values, and Eigen vectors of a matrix. Caley- Hamilton theorem, Quadratic Form.

Books Recommended:

- Advanced Engineering Mathematics by E.Kreyszig
- Differential equations and its applications, H.T.Piaggio, Prentice-Hall
- Applied Mathematics for Engineers by P.N.Wartikar
- Advanced Engineering Mathematics,2/e by Greenberg, Pearson education, 2004
- Ordinary and partial Differential equation, M.D. Raisingania, S.Chand and Co
- Linear Algebra,Hoffmann & Kunze, Prentice-Hall
- Mathematical Analysis by S.C.Malik & Savita Arora New Age international Limited
- Integral Calculus by Shanty Narayan.

EE -204T- Professional Communication & Moral Ethics

L – P

4 – 0

Unit I

Communication: definition and description; types of communication; body language; barriers to Communication. Speech sounds: description and articulation of Phonemes, words, word stress, sentence stress and intonation in basic patterns; basics of connected speech and conversational patterns.

Unit II

Written communication: nature, styles and types, Report writing; structure, drafting and types; business correspondence: purpose, types of business letters; resume; proposals and invitations; emails. Presentation: skills and deliverance; making and answering phone calls; debating and group discussions; facing interviews.

Unit III

Engineering ethics, Nature and scope, Types of ethics: Common ethics, Personal ethics, Professional ethics, Origin of ethical theories, Rights and responsibilities of engineers, Case studies.

Unit IV

Islamic perspective on ethics and education, concept of rights and duties in Islam, sociological perspective on education, social and value implications of technology, Environmental Obligations on Engineers

Unit V

Moral development, Different stages of moral development; pre-conventional, conventional and post-conventional, Moral and non-moral actions, Impediments to responsible action, Computer ethics, Computer Crimes, need of computer ethics, hacking, Bio-Ethics,

RECOMMENDED BOOKS:

1. Battacharaya, Inderjit. An Approach to communication Skills.
2. P.D. Chaturvedi and M. Chaturvedi, Business Communication, Delhi: Pearson Education, 2006.
3. Charles B. Fleddermann, Enginerring Ethics 2nd ed. Pearson education Inc.
4. FrankanaWalliam .K :Ethics
5. Sinha. J.N :Manual of Ethics

EE - 205T- Engineering Mechanics

L – P

4 – 0

Unit I

Analysis of Stresses & Strains: Forces & stresses, normal stress & normal strain, axial loading, stress strain diagram (mild steel), mechanical property, Hooke's law, modulus of elasticity, ultimate & allowable stress, factor of safety, composite sections, bars of varying cross section, superposition principle, temperature stresses, Poisson's ratio, bulk modulus, shear strain, relation among E, V, & G.

Unit II

Moments of Area of Plane Area: Centre of gravity (symmetrical & Unsymmetrical section), moment of inertia of (symmetrical & unsymmetrical section), parallel axis theorem, perpendicular axis theorem, radius of gyration.

Unit III

Bending moment & shearing force: Notation & sign convention for fluctuating loads, shear force & bending moment diagram of determinate structures (cantilever, simply supported beams & varying load beams) supported to point loads, UDL, VDL, computing of reactions using equation of equilibrium.

Unit IV

Trusses: Planar truss structures, idealisation of planar structures, sign convention & member force representation. Analysis of trusses with method of joints, sections and graphical

Unit V

Torsion in Shafts: Preliminary discussion of stresses in a shaft, deformation in a circular shaft, polar moment of inertia, angle of twist, design of transmission shaft.

Books Recommended

- Shames I.H, Engineering Mechanics, Prentice Hall, New Delhi.
- D.S.Kumar, Engineering Mechanics, S.K.Kataria & Sons, New Delhi.
- R.S.Khurmi, Strength of Materials, S.Chand & Company Ltd, New Delhi.

EE – 206P - Machine Drawing

L – P

3 – 2

UNIT I: Principles of Sectioning, types of Sections, standard practices.

UNIT II: Nut and Bolt, types and their assembly, threads and various types of screw threads, threaded fasteners, locking devices, foundation bolts.

Permanent fasteners: Rivet and riveted Joints, welding symbols and welding joints.

UNIT III: Pin and cotter joints (temporary fasteners), Spigot and socket type cotter joint, sleeve type cotter joint, knuckle joint, Gib and cotter joint.

UNIT IV: Keys and Shaft Couplings (temporary fasteners), Flanged (Protected and unprotected), Muff coupling (Pin type), friction coupling, clutches, Oldham coupling and universal coupling.

UNIT V: Shaft bearing: Type of Bearings, journal bearings, pivot bearings, thrust bearings, ball bearings, bearing bracket, hangers and ball bearings.

Books Recommended:

1. P.S Gill Machine Drawing
2. N.D Bhatt Machine Drawing

EE - 207P - Computer Programming Lab

L – P

0 – 3

Introduction to Pointers: A first look at pointers, declaring pointers, using pointers, naming pointers, pointer operators, pointer expression and pointer arithmetic.

Arrays and Pointers: Arrays and pointers in practice, multidimensional arrays, and pointers, accessing array elements, dynamic memory allocation – The Malloc function.

Characters and Strings: Fundamentals of strings and characters, character handling library, string conversion function, standard I/O library function, comparison, search and memory function of string.

Structures : Definition, initializing, assigning values, passing of structures as arguments, Arrays of structures, pointers to structures, self referential structures. Unions, typedef, bit fields, C program examples.

Console & File I/O : Standard I/O, Formatted I/O, opening & closing of files, I/O operations on files.

Books Recommended:

- *C How to Program*, Deitel & Deitel, Prentice hall
- *Let us C*, Yashavant kanetkar, BPB Publications

Lab Programs

1. Write a program in C to copy one array to another array ?
2. Write a program in C to merge two arrays ?
3. Write a program in C to read and display biodata using structures ?
4. Write a program in C to read and display integer array using functions ?
5. Write a program in C to read and display biodata using functions ?
6. Write a program in C to read and display a 3 x 3 Matrix ?
7. Write a program in C to transpose the 3 x 3 Matrix ?
8. Write a program in C to print the sum of two 3 x 3 Matrix. ?
9. Write a program in C to print the product of two 3 x 3 Matrix ?
10. Write a program in C to read and display a N x N Matrix ?
11. Write a program in C to transpose the N x N Matrix ?
12. Write a program in C to print the sum of two N x N Matrix ?
13. Write a program in C to print the product of two N x N Matrix ?
14. Write a program in C to read and display a M x N Matrix ?
15. Write a program in C to transpose of M x N Matrix ?

16. Write a program in C to print the sum of two M x N Matrix ?
17. Write a program in C to print the sum of two M x N Matrix ?
18. Write a program in C to find sum of two matrices using array
19. Write a program to sort a 4X4 matrix
20. Write a function to swap two numbers using call by reference.
21. Write a function to find minimum of an array using pointers.
22. Write a function to reverse a string using pointers.
23. Write a program in C to convert upper case letters into lower case?
24. Write a function to store names of students using (character) pointer arrays.
25. Write a program in C to encrapt the given file?
26. Write a program in C to decrapt the given file?
27. Write a program in C to copy the file contents into array?
28. Write a program in C to display page by page of the file contents including line number. ?
29. Write a program in C to display line by line and count the no of upper and lower case letters and numbers?
30. Write a program in C to display page by page of the file contents including line number. ?
31. Write a program in C to display line by line and count the no of upper and lower case letters and numbers?
32. Write a program in C to print the particular line when pattern is occurred using command line arguments.(grep command in unix:) ?
33. Write a program in C to print the particular line with line number when pattern is occurred using command line arguments in all files(Grep command in unix:) ?
34. Write a program in C to read and store the bio-data into file ?
35. Write a program in C to read the bio-data from file and print it to the screen?
36. Write a program in C to read the bio-data from file and calculate hra and da?
37. Write a program in C to display the Nth record ?
38. Write a program in C to edit the n th record ?
39. Write a program to sort all the records in a file (containing student record) based on their marks
40. Write a program in C to read and display the bio-data of 10 students using structure?
41. Implement above structure based programs using dynamic memory allocation.
42. Implement linked lists and perform addition, deletion, searching.
43. Write a program in C to read and display the sum of two complex numbers?
44. Write a program in C to read the biodata from file using command line arguments?
45. Write a program in C to display the text from file using command line arguments (cat command in unix) ?
46. Write a program in C to copy one file to another file using command line arguments (cp command in unix) ?

EE - 208P – Physics - II Lab

L – P

0 – 2

- Lab 1** Determination of refractive index of prism by spectrometer.
- Lab 2** Determination the wavelength of sodium light by diffraction grating.
- Lab 3** Determination of Wavelength of sodium light by Newton's ring.
- Lab 4** Study of Zener diode voltage regulating characteristics.
- Lab 5** To study double slit interference by He-Ne laser.
- Lab 6** To plot the graph for the transistor characteristics.
- Lab 7** To plot the graph for the semi-conductor diode.
- Lab 8** To find the dead time of a G. M. Counter.

EE - 209P – Chemistry - II Lab

L – P

0 – 2

List of Experiments

- 1) Synthesis of the phenol formaldehyde resin
- 2) Synthesis of the urea formaldehyde resin
- 3) To determine the temporary and permanent hardness of the a sample of water by complexometric titration
- 4) To determine the Alkalinity of the given sample of water
- 5) Determination of the ion exchange capacity of cation exchange resin
- 6) Determination of the ion exchange capacity of anion exchange resin
- 7) Titration of Fe (II) Vs K_2CrO_7 and Determination of Redox potential of Fe^{2+} / Fe^{3+}
- 8) Estimation of Copper in Brass with sodium thiosulphate
- 9) To determine the concentration of the $KMnO_4$ solution using spectrophotometer.

Demonstration of Experiments

Determination of specific rotation of the sucrose by Polarimetry

Spectrophotometer (concentration determination, wavelength maximum)

B-Tech Electrical Engineering

Semester-III

Course Code	Course Title	L – P	Credit
EE 301T	Basics of Electronics	3 – 0	3
EE 302T	Network Analysis	3 – 0	3
EE 303T	Basic Electrical Engineering	4 – 0	4
EE 304T	Electrical Engineering Materials	3 – 0	3
EE 305T	Electromagnetic Fields and Waves	3 – 0	3
EE 306T	Mathematics-III	4 – 0	4
EE 307T	Basic Mechanical Engineering	3 – 0	3
EE 308P	Basics of Electronics Lab	0 – 2	1
EE 309P	Basic Electrical Engineering Lab	0 – 3	2
EE 310P	Introduction to MATLAB	0 – 2	1
	Total Credits	23 – 7	27

EE - 301T – Basics of Electronics

L – P
3 – 0

Unit-I

Introduction to Semiconductors: p and n types, transport mechanism of charge carriers, electric properties, Hall effect, Electronic Devices, their characteristics and applications.

Unit-II

PN junction diode: current components in p-n junctions, characteristics-piecewise linear approximation, temperature dependence, diode resistance, diode capacitance, switching times, circuits etc, basic operation of zener diode, avalanche breakdown diode, schottky diodes, tunnel diode

Unit-III

Rectifiers (Half wave rectifier, Full wave rectifier: CT & Bridge type), filters (pie and T), clippers, clampers, peak detector, sampling gate, voltage multipliers.

Unit-IV

Transistors: Current components of transistor, Types, operation and characteristics, Ebers-Moll model, CE, CB and CC configurations, input-output characteristics and graphical analysis of basic amplifier circuits, thermal; runaway, Early-Effect.

Unit-V

Special semiconductor devices: TRIAC, DIAC, SCR, UJT, Photodiode, Phototransistor, LCD, LED, MOS, VMOS, Solar cells, Photoconductive cell, Cathode Ray Oscilloscope: Basic operation and measurement applications

.Books Recommended:

- Electronic Circuits by D.Schelling and C.Belove
- Integrated Electronics by Millman&Halkias.
- Electronic circuits by G.Grob.
- Electronic Devices and Circuit Theory by Boylestead and Nashelsky. 1994
- Microelectronic Circuits Adel S. Sedra and Kenneth C. Smith.

EE - 302T - Network Analysis

L – P

3 – 0

Unit-I:

Development of the circuit Concept: Charge and energy, capacitance, inductance and resistance parameters in the light of field and circuit concepts. Approximate realization of a physical system as a circuit.

Conventions for describing networks: Reference directions for currents and voltages, conventions for magnetically coupled circuits. Circuit topology.

Unit-II:

First order differential equation: Differential equations as applied in solving networks. Application of initial conditions. Evaluating initial conditions in networks.

Laplace Transformation properties, Solution of Network problems with Laplace transformation.

Wave form analysis and synthesis: The unit step, ramp and impulse functions and their Laplace transforms. Initial and final value of $f(t)$ from $f(s)$.

Convolution integral, convolution as summation.

Unit-III:

Network theorems and impedance functions: Complex frequency, transform impedance and transform circuits, series and parallel combinations of elements.

Network Functions-poles and zeros: Network functions for one port and two port networks (ladder and general networks). Poles and zeros of network functions. Restriction on pole and zero locations for driving point and transfer functions. Time domain behavior from pole zero plot.

Unit-IV:

Two port parameters: Relationship of two port parameters. Admittance, impedance, transmission and hybrid parameters. Relationship between parameter sets. Parallel connection of two port Networks. Characteristics impedance of two port networks .

UNIT –V:

Filter fundamentals – pass and stop band, filter classification, constant K & m derived filters, Behaviour of characteristic impedance over pass & stop bands, design of filters.

Books Recommended:

1. Network analysis by Van Valkenberg
2. Network Analysis and Synthesis F. Kuo.
3. Ryder JD, Networks ,Fields and lines

EE - 303T- Basic Electrical Engineering

L – P

4 – 0

Unit-I

Electric Circuits Laws: Basic electric circuit terminology, Ohm's law, Kirchhoff's current law (KCL) and Kirchhoff's Voltage law (KVL) , circuit parameters (resistance, Inductance and capacitance) , series and parallel combinations of resistance, Inductance and capacitance , Nodal analysis.

Unit-II

Energy Source, Ideal and Practical voltage and current sources and their transformation, Dependent voltage sources and dependent current sources, D.C. Circuit Analysis, Power and energy relations, Analysis of series and parallel DC circuits,

Unit-III

Loop and Nodal methods of circuit analysis, Superposition theorem, Thevenin's and Norton's theorems, maximum Power theorem, Delta - star (Y) Transformation

Unit-IV

A.C. CIRCUIT ANALYSIS: Basic terminology and definitions, Phasor and complex number representation, solutions of sinusoidally excited RLC circuits, Power and energy relations in A.C. circuits, Applications of network theorems to A.C. circuits, Resonance in series and parallel circuits, Concepts of active & reactive powers.

Unit-V

Steady State A.C three phases Circuits:, Concept of a 3-phase voltage, wye (Y) circuits. Delta (Δ) circuits, Current and voltage relations in Y and Δ Circuits, Characteristics of a 3 -phase system, Magnetically Coupled circuits, Mutual inductance

Books Recommended

1. Fundamentals of Electric Engineering by Bogart , Tata McGraw Hill,1998
2. Electrical Engineering Fundamentals by Deltoro, Prentice Hall India (PHI)
3. Theory and problems of Basic Electric engineering by Nagrath and Kothari..PHI
4. Basic Electric Engineering by Cathey, Schaum's outline series, Tata McGraw Hill
5. Circuit analysis by William Hayat, Tata McGraw Hill, 2nd Ed

EE - 304T - Electrical Engineering Materials

L – P

3 – 0

Unit-I

Crystal structure: crystalline state, Bravais lattices, Miller indices, Reciprocal lattice, Common Crystal structures, Crystalline Interference, Bragg Diffraction, crystal imperfections

Unit-II

Free electron theory, conduction in metals and alloys, conductors and resistors, Materials for resistors, Some important resistor alloys, capacitors and inductors

Unit-III

Magnetism, magnetic properties of materials; diamagnetic, paramagnetic and ferromagnetic properties of materials, ferro-magnetism and anti-ferromagnetism, ferrites and other magnetic materials

Unit-IV

Some important carbon steels and precipitation hardening type magnet alloys and their applications. Optical properties of materials. Growth of single crystals, Zone refining techniques, vapour phase deposition,

Unit-V

Dielectric materials and their properties, dielectric constant, properties of optical materials, piezo-electricity. Semiconductors, their properties and applications, superconducting materials

Recommended Books:

1. Introduction to solid-state physics by Kittel
2. solid state physics by Dekker
3. Material science & Engineering by Raghavan
4. Electronics & materials by Streetman
5. Dielectric Materials and Application by A.R. Van Hippel.

EE - 305T- Electromagnetic Fields and Waves

L – P

3 – 0

Unit-I

Electrostatics Curvilinear Coordinates, The Dirac-Delta Function, Helmholtz Theorem, Scalar and Vector Potentials, The Electrostatics field, Divergence and Curl of electrostatics fields, Applications of Gauss law, Introduction to potential, Poisson equation and Laplace equation

Unit-II

Special Techniques for Calculating Potentials Laplace equation in one, two & three Dimensions, Boundary conditions and uniqueness theorem, Conductors and the 2nd uniqueness theorem, The classic image problem, The induced surface charge, Force and energy other image problems, The Electric field of a dipole

Unit-III

Magnetostatic Fields The Lorentz force law, The Biot-Savarts law, Divergence and curl of B, Magnetic Vector potential, Magnetostatic Boundary conditions, Multipole expansion of the Vector Potential, Magnetization, Torque and force on magnetic dipoles, Amperes law in magnetized material, Magnetic Susceptibility and permeability.

Unit-IV

Electromagnetic Waves Electromagnetic wave in one Dimension, Sinusoidal waves, Polarization, Boundary condition, Reflection and transmission, Energy and momentum of electromagnetic waves, Propagation through linear media, Reflection and refraction at oblique incidence, electromagnetic waves in conductors, Rectangular Wave guides, TE and TM modes.

Unit-V

Electrodynamics Electrodynamics before Maxwell, Maxwell's equations and magnetic charge, Maxwell's equation inside matter, Boundary conditions, Scaler and vector potentials, Lorentz force law in potential form, Newton's third law in electrodynamics, Poynting theorem, Maxwell's Stress tensor, Conservation of momentum,

Recommended Books:

1. David J. Griffiths "Introduction to electrodynamics" [PHI-Pvt Ltd, New Delhi –India 3rd Edition.
2. J.D. Jacson "Electrodynamics".
3. Arfken Weber "Mathematical method for Physicists"- Harcourt (INDIA).
4. L.D. Landau, E.M. Lypshitz " Classical Theory & Fields)

EE -306T- Mathematics - III

L – P

4 – 0

Unit-I:

Laplace transform, Shifting theorem, Laplace transforms of different functions, Heaviside's unit function, Dirac Delta function and its Laplace transforms, Heaviside's expansion theorem.

Unit-II:

Inverse Laplace transforms, Initial and final value theorems, convolution theorem and applications, use of Laplace transforms in the solution of linear differential equations.

Unit-III:

Bessel's functions, Recurrence relations, modified Bessels function of first kind.

Legendre polynomials, Rodrigues formula, Recurrence relations.

Unit-IV:

Definition of Fourier transform, Fourier Sine and Cosine transform, Fourier integral formula.

Unit-V:

Introduction to complex variables, analytic functions, harmonic conjugate, conformal transformation of some simple functions.

Recommended Books:

1. Laplace Transforms by Spiegel (Schaum Series)
2. The use of Integral Transforms by Iam.N.Snedden, Tata McGraw Hill
3. Integral Transforms by Loknath Debnath, C.R.C. Press, New York.
4. Complex variables and applications by R.V. Churchill, McGraw Hill International Book Company
5. Advance Engineering Mathematics by R.K.Jain & S.R.K. Iyengen-Norosa-2001.
6. Higher Engineering mathematics, BS Grewal, Khanna Publishers, Delhi

EE -307T- Basic Mechanical Engineering

L – P

3 – 0

Unit I: Thermodynamics

Thermodynamic work, p-V work in various processes, p-V representation of various thermodynamic Processes and cycles

Ideal gas equations, Properties of pure substance, Statements of I and II laws of thermodynamics and their applications in Mechanical Engineering.

Carnot cycle for Heat engine, Refrigerator and Heat pump.

Unit II: Energy conversion devices (Theoretical study using schematic diagrams only)

Package Boiler, Working principle and applications of Reciprocating I.C. engines, Reciprocating pumps (single acting & double acting), reciprocating compressor, rotary compressors, Study of household refrigerator window and split type air conditioner.

Unit III: Heat Transfer

Newton's law of cooling, Stefan Boltzmann's law. Conducting and insulating materials and their properties, Selection of heat sink and heat source.

Unit IV: Power Plants (Description with Block Diagrams):

Thermal, Hydroelectric, Nuclear and Solar-Wind Hybrid Power Plants.

Unit V: Machine Elements and Power Transmission Devices

Flywheel and Governors, Types of Belts and belt drives, Chain drive, Types of gears, Types of Couplings, friction clutch (cone and single plate), brakes (types and applications only)

REFERENCES

1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Company, New Delhi, (1996)
2. Steam Turbine Performance and Economics, Bartlett, McGraw Hill
3. Steam Turbine Theory and Practice, Kearton Pitman, CBS Publishers
4. Gas Turbines Theory and Practice, Cohn and Rogers, Pearson
5. Turbo machines, Yahya, McGraw Hill

EE – 308P – Basics of Electronics Lab

L – P

0 – 2

- | | |
|---------------|---|
| Lab 1 | To obtain diode characteristics |
| Lab 2 | To assemble a half wave and full wave rectifier and to study their performance |
| Lab 3 | To obtain Zener diode characteristics and use Zener diode as a voltage regulator |
| Lab 4 | To assemble and observe the performance of clipping and clamping circuits |
| Lab 5 | To obtain transistor characteristics in the following configurations.
i).common base

ii).common emitter |
| Lab 6 | To assemble a CE amplifier and observe its performance |
| Lab 7 | To obtain frequency response of a RC coupled CE amplifier |
| Lab 8 | To assemble an emitter follower circuit and observe its performance |
| Lab 9 | To obtain JFET characteristics and to observe performance of a source follower |
| Lab 10 | To illustrate use of FET as a voltage variable resistor |
| Lab 11 | Project Presentation |

EE -309P - Basic Electrical Engineering Laboratory

L – P

0 – 3

List of Experiments

Experiment No: 1

To study the color coding of resistors.

Connection of Ammeters, voltmeters, Wattmeter's and Millimeters in DC and AC circuits and selection of their ranges.

Use of LCRQ meter.

Experiment No: 2

To study the series and parallel operation of resistors and verifying their effective values by LCRQ meter.

b) Repeat the same for inductors.

c) Repeat the same for capacitors.

Experiments on D.C. Circuits:

3. To verify the KVL and KCL in D.C. circuits.
4. To verify the star delta transformation of networks.
5. To verify the superposition theorem.
6. To verify the maximum power transfer theorem.
7. To verify Norton's Theorem.
8. To verify Superposition Theorem.

Experiments on A.C. Circuits:

9. To measure electric power in single phase AC circuits with resistive load, RL load and RLC load.
10. To measure the power and power factor in three phase AC circuits.
- 11 To study the series resonance.
12. To study the parallel resonance.

EE -310P – Introduction to MATLAB

L – P

0 – 2

Basics of MATLAB, MATLAB windows, Arithmetic calculations, use of variables, arrays, matrix & Array operations; Arithmetic, Relational & Logical Operations, Elementary math functions, character settings, saving & loading data, Mat-files, Matrix functions.

Programming in MATLAB, Script files, Function files, Global variables, Loops, branches & control flow, interactive input, graphics: 2-D & 3-D plots, style options, titles, axes control, zoom.

Curve fitting, Interpolation, Eigen values & Eigen Vectors.

B-Tech Electrical Engineering

Semester-IV

Course Code	Course Title	L – P	Credit
EE 401T	Electrical Machines-I	4 – 0	4
EE 402T	Digital Electronics & Logic Design	3 – 0	3
EE 403T	Control Systems-I	4 – 0	4
EE 404T	Electronic Devices & circuits	3 – 0	3
EE 405T	Mathematics-IV	4 – 0	4
EE 406T	Hydraulics and Hydraulic Machines	3 – 0	3
EE 407P	Electrical Machines-I Lab.	0 – 3	2
EE 408P	Digital Electronics & Logic Design Lab	0 – 3	2
EE 409P	Control System Lab	0 – 2	1
EE 410P	Electronic Devices & circuits Lab	0 – 2	1
	Total Credits	21 - 10	27

EE - 401T – Electrical Machines-I

L P
4 0

Unit I: Single Phase Transformers

Introduction, classification, construction, electromotive force (e. m. f.) equation, Equivalent circuit model, Phasor diagrams, Losses and efficiency, Voltage regulation, Transformer tests (polarity test, open circuit test and short circuit test), All day efficiency, Parallel operation, Auto-transformers, Excitation phenomenon in transformers

Unit II: Three Phase Transformers & Special Purpose Transformers

Construction, Connections, Open delta, Ratings, Phase Conversions, Impedance matching transformers, Isolation transformers, constant current and constant voltage Transformers, Instrument Transformers (Introduction)

Unit III: Principles of Electromechanical Energy Conversion

Energy conversion via electric and magnetic fields, Field energy and mechanical force, energy balance, co-energy

Unit IV: Direct current Generators:

General introduction, principles of operation of D.C Generators, construction of D.C Generators, Types of DC Generators, e.m.f equation, Types of windings, power stages and efficiency, commutation and armature reaction, characteristics of D.C Generators, Applications of DC Generators

Unit V: Direct current Motors:

Principles of operation of D.C Motors, construction of D.C Motors, Types of DC Motors, Back e.m.f and Torque equation, torque and speed of D.C Motors, characteristics of various types of D.C motors, speed control of D.C motors, starting and electric braking.

Books Recommended:

1. Electric Machinery by Fitzgerald, Kingslay, Umans
2. Electric Machinery Fundamentals by Chapman
3. Electric Machines by Nagrath and Kothari
4. Electric Machinery and Transformer by Guru, Hiziroglu

EE - 402T – Digital Electronics & Logic Design

L P
3 0

UNIT-I: Logic Families

RTL, DTL, TTL, ECL, ICL, HTL, NMOS and CMOS logic gates, circuit diagram and analysis, characteristics and specifications, tri-state gates, totem-pole configuration.

UNIT-II: Number Systems and Codes

Binary, octal, and hexa- decimal number systems, binary arithmetic, binary code, excess-3 code, gray code, error detection and correction codes. Boolean algebra: Postulates and theorems, logic functions, minimization of Boolean functions using algebraic, Karnaugh map and Quine – McClusky methods, realization using logic gates.

UNIT-III: Combinational Circuits

Introduction to combinational circuits, realization of basic combinational functions like Adder, Subtractor, Encoder/Decoder, Multiplexer, Comparators, delays and hazards in combinational circuits, code converters.

Unit-IV: Sequential Circuits

Flip-Flops: SR, JK, T, D, Master/Slave FF, triggering of FF, analysis of clocked sequential circuits-their design, state minimization, state assignment, circuit implementation, registers: shift registers, inter-conversion of shift registers, Ripple counters.

UNIT-V: Programmable Logic Devices (PLD's):

PAL, PLA, GAL, FPGA, Evolution and introduction to microprocessors, internal architecture(ALU, Register Array, timing and Control Unit), Organization of microprocessor based system. Input/output devices, system bus, microprocessor languages(machine language, assembly language), ASCII code.

Books Recommended:

1. Morris Mano, "Digital logic and Computer Design ", Prentice-Hall of India.
2. Ronald J. Tocci, "Digital Systems, Principles and Applications", Prentice-Hall of India.
3. Jain R.P., "Modern Digital Electronics ", Tata McGraw Hill.
4. Floyd T.L., "Digital Fundamentals ", Charles E. Merrill Publishing Company.

EE - 403T – Control Systems-I

L P
4 0

Unit-I: Introduction and Modeling of linear Control Systems:

Control Systems- examples and classification; Open Loop and closed loop control systems and their differences; Transfer functions; Block diagram representation of systems; Signal flow graphs - Reduction using Mason's gain formula; Models of some Industrial Control Devices and Systems.

Unit-II: Time Response Analysis:

Standard test signals; Time domain performance of first and second order control systems-time domain specifications of these systems-steady state and transient response, steady state errors and error constants, Introduction to the State variable representation.

Unit-III: Stability and PID Controllers:

The concept of stability, BIBO stability, Relation between characteristic equation roots and BIBO stability, Routh-Hurwitz stability criterion, Relative stability analysis. Proportional, Integral, Derivative(P,I,D) Control with characteristics.

Unit-IV: Root Locus and Frequency Response Analysis : The Root locus technique and its Construction Principles; Frequency response and Frequency domain specifications; Bode diagrams - Determination of Stability, Phase Margin and Gain Margin from the Bode Diagrams; Nyquist Methods - Determination of Stability, Phase Margin and Gain Margin from the Nyquist Diagrams;

Unit-V: Classical Control System Design Methods:

Control System Design using Root Locus methods - Relationship between Root Locus and Time Domain – Cascade (Lag, Lead, Lag-Lead, PI, PID) and Feedback (PD) compensation using Root Locus plots; Compensator design using Bode plots - Cascade (Lead, Lag, Lag-Lead, PI, PID) and Feedback (PD) compensation.

Text Books:

1. **Norman S. Nise** - Control Systems engineering, 4th edition John Wiley and Sons.
2. **Gopal M.** - Control Systems–Principles and Design, Tata McGraw-Hill Ltd., 3rd edition.

Reference Books:

1. **Stefani R., Savant C., Shahian B., Hostetter G.** - Design of Feedback Control Systems, Saunders College Publishing, 3rd edition.
2. **Ogata Katsuhiko**- Modern Control Engineering, Prentice Hall of India Pvt. Ltd., 3rd edition.

EE - 404T - Electronics Devices and Circuits

L – P
3 – 0

Unit-I

Transistor Biasing, Bias stability, h-parameters: low frequency h-parameter model, analysis and design of transistor amplifier circuits using h-parameters

Unit-II

High frequency hybrid-pi model, analysis and design of transistor amplifier circuits at high frequencies, Multistage Amplifiers

Unit-III

JFET's: operation and characteristics, models, application as low and high frequency amplifiers, MOSFET types, operation and characteristics, biasing and h-parameter model

Unit-IV

Feedback Basics, negative feedback, effect of negative feedback on the performance of amplifiers e.g., on bandwidth, types of feedback amplifiers, current-shunt, current-series, voltage-shunt and voltage series feedback, analysis of the feedback amplifier circuits, sinusoidal oscillators: basic operation, analysis of general oscillator circuits, barkhausen criterion, various types of oscillator circuits and their analysis: Hartley, Colpitts, Crystal, Phase shift, Wein bridge, design of practical oscillator circuits.

Unit-V

Power Amplifiers: classification of power amplifiers, Class A , Class B, Class AB and Class C power amplifiers, analysis and design, power supplies and IC regulators, Multivibrators: bi-stable, mono-stable and astable multivibrator circuits and their analysis, Wave form generators, triangular and square wave generators

Books Recommended:

- 1. Integrated Electronics by Millman&Halkias.**
- 2. Electronic Devices by Robert .L. Boylested& Louis Nashlesky**

EE - 405T – Mathematics - IV

L P
4 0

Unit-I:

Statistics: Measures of central tendency and Measures of variations (Dispersions), Moments, Measures of Skewness and Kurtosis. Moment generating functions, problems.

Unit-II:

Probability: Random experiment, sample space, events, classical, statistical and axiomatic definitions of probability. Statements and proof of theorems on addition and multiplication of probabilities, problems.

Unit-III:

Conditional Probability: Bayes theorem on conditional probability. Random variables, Derivation of formulae for mean, variance and moments of random variables for discrete and continuous cases. Laws of expectation problems.

Unit-IV:

Standard Distributions: Binomial, Poisson and Normal Distributions, Beta and Gamma Distribution, t Distribution, F-Distribution, Chi-square Distribution and their applications.

Unit-V:

Method of Least Squares & Correlation: Methods of least squares, fitting of straight line and parabola of degree 'p'. Regression and Correlation. Multiple and Partial Correlation. Problems

Books Recommended:

1. Fundamentals of Mathematical Statistic by S.C.Gupta and V.K. Kapoor, Sulltan Chand & Sons New Delhi, Latest edition.
2. Statistical Theory and Methodology in Science & Engineering by Brownlee, John Wiley & Sons.
3. Introduction to Mathematical Statistics by R.E.Walpole 3rd edition New York Macmillan publication.
4. Data Analysis for Scientists & Engineers by Meyer, John Wiley & Sons.

EE - 406T – Hydraulics and Hydraulic Machines

L P
3 0

Unit-I: Physical Properties of Fluids:

Fluid Statics: Pressure Intensity, Pascal's law, pressure density height relationships, manometers, pressure on plain and curved surfaces, centre of pressure.

Unit-II: Kinematics and Dynamics of Fluid Flow:

Types of flows, stream lines, streak lines and oath lines, continuity equation.

Euler's equation of motion along a stream line and its integration to yield Bernouli's equation. Flow measurement, pitot tube, Venturimeter, orifice meter, orifices, Weirs and Notchces.

Unit-III: Flow through Pipes:

Hydraulic grade line, Darcey-weisbach formulla, Design of pipes, Equivalent diameter of pipes, Transmission of power through pipes.

Unit-IV: Flow in open Channels:

Chezy's formula, Manning's formula, Design of Cannels, Economic section, General layout and arrangement of Hydropower units.

Unit-V: Hydraulic Machines:

Types of turbines, description and principles of Impulse and reaction turbines, unit quantities and specific speed, run away speed, turbine characteristics, selection of turbines, governing of turbines, centrifugal pumps, specific speed, Power requirement, Reciprocating pumps.

EE – 407P – Electrical Machines-I Laboratory

L P
0 3

Experiments on Transformers

1. To perform open circuit and short circuit tests on a single-phase transformer
2. To perform polarity test on a single phase transformer
3. To determine the efficiency and voltage regulation of a single phase transformer
4. To perform Sumpner's test on two identical transformers
5. To study three phase connections on a bank of three single phase transformers

Experiments on Direct Current Machines

1. To study various parts of a dc machine and draw sketches of the same.
2. To plot the saturation curve of a dc machine.
3. To plot the external characteristics of a separately excited dc generator.
4. To study the voltage build up of a dc shunt generator.
5. To plot the external characteristic of a dc shunt generator and compare the characteristics with that of a separately excited generator.
6. To plot the external characteristics of a dc series generator.
7. To plot the external characteristic of a dc compound generator and compare the characteristics when run as a shunt generator, an over compound generator, a flat compound generator, an under compound generator and differentially compounded generator.

EE – 408P – Digital Electronics & Logic Design Lab

L P
0 3

List of Experiments

1. To verify the truth table of following logic gates:
AND, OR and NOT. NAND, NOR, XOR and XNOR.
2. To realize the above gates using discrete active and passive components.
3. To implement XOR and XNOR using universal logic gates.
4. To verify DE Morgans law using logic gates.
5. To implement certain Boolean expressions and check their equality.
6. To design and realize
 - a) Half adder and verify its truth table.
 - b) Full adder and verify its truth table.
 - c) Half subtractor and verify its truth table.
 - d) Full subtractor and verify its truth table.
7. To design a multiplexer/ demultiplexer using two input NAND gates.
8. To design a 4-bit binary to decimal convertor.
9. To design a modulo 10 counter.
10. Given the frequency f obtain the waveforms with frequencies $f/2$, $f/5$ & $f/10$.
11. Design and realize the following flip-flops using logic gates.
a) RS flip flop **b)** JK flip flop. **c)** D flip flop **d)** T flip flop.
12. Use PLL as a) Frequency multiplier. b) Frequency demodulator.
13. MINI PROJECT: Design and fabricate a frequency counter/clock.

EE- 409P- Control System Laboratory

L P
0 2

List of Experiments:

1. To study the performance of Relay control Combination of P, I and D control schemes in a Temperature control system.
2. To study the torque-speed characteristics of an AC servomotor, determine its parameters and evaluate its transfer function.
3. To study the open loop and closed loop step response of first, second and third order simulated linear systems.
4. To study D.C. motor angular position control system, step response studies for various values of forward gain.
5. Study the effect of velocity feedback on the transient and steady state performance of D.C. motor speed control system.
6. Control System Analysis and Design using MATLAB

EE- 410P – Electronics Devices and Circuits Lab

L – P

0 – 2

Lab schedule

- Lab 1 To plot the Gain-frequency response of CE Amplifier
- Lab 2 To plot the Gain-frequency response of a CB amplifier
- Lab 3 To plot the gain-frequency response of a Emitter follower Amplifier
- Lab 4 To study the gain-frequency response of a cascaded amplifier
- Lab 5 To determine g_m and r_{out} of a JFET
- Lab 6 To plot the I-V characteristics of a BJT and determine h_{fe} , h_{ie} and h_{oe}
- Lab 7 To plot the I_E - V_E characteristics of a UJT
- Lab 8 to study a relaxation oscillator using a UJT
- Lab 9 To study the operating characteristics of a Solar Photo-voltaic Cell
- Lab 10 To draw the characteristics of a SCR

5th Semester

Course Code	Course Title	L – P	Credit
EE 501T	Electrical Machines-II	4 – 0	4
EE 502T	Electrical Measurements & Instrumentation	4 – 0	4
EE 503T	Microprocessors	3 – 0	3
EE 504T	Communication Systems	3 – 0	3
EE 505T	Mathematics-V	4 – 0	4
EE 506P	Electrical Machines-II Lab	0 – 3	2
EE 507P	Electrical Measurements & Instrumentation Lab	0 – 3	2
EE 508P	Microprocessors Lab	0 – 3	2
	Total Credits	18 – 9	24

EE - 501T –Electrical Machines-II

L P
4 0

UNIT I

The rotating magnetic field, Magneto-motive force and flux distribution, Induced voltage, Production of torque, Leakage fluxes

UNIT II

Three Phase Induction Motors Principle of operation of an induction motor, Construction, Types, slip, Equivalent circuit, Torque/speed characteristics, losses and efficiency, crawling and cogging, Induction motor tests, Starting, Speed control

UNIT III

Double field revolving theory, Types of 1-phase induction motors, Equivalent circuit of 1-phase induction motors, Shaded-pole Motor, Stepper Motor, Universal Motor,

UNIT IV

Constructional features, Types and working principle of alternators, EMF equation, windings, pitch factor and distribution factor, leakage reactance, armature reaction, Equivalent circuit, phasor diagram, short circuit ratio (SCR), voltage regulation and its determination, Two-axis theory for salient type machines

UNIT V

Construction, principle of operation, starting, Effect of load on synchronous motor, Effect of varying excitation, Equivalent circuit, Phasor diagram, different torques, V and inverted V curves, hunting, damper windings, Synchronous condenser/ synchronous phase Modifier

Books Recommended:

1. Electric Machinery by Fitzgerald Kingslay, Umans Tata Mcgraw hill 2002
2. Electric Machines Nagrath and Kothari Tata Mcgraw hill 2010
3. Electric Machines Guru Oxford university press 3rd edition 2000
4. Electrical Machines and Transformers GerogeMcPherson John Wiley 1990 5.
5. Electric Machinery Fundamentals Chapman Tata Mcgraw hill 2010
6. Electric machinery by Dr. P.S. Bimbhra, Khanna Publishers

EE - 502T –Electrical Measurements & Instrumentation

L P
4 0

UNIT-I

Units, dimensions, classification of errors, accuracy and precision, statistical analysis of errors, standards for measurement, temperature, emf, resistance, current, inductance, capacitance. Methods of measurements. Classification of instruments- absolute, secondary, indicating, recording, integrating.

UNIT-II

Instruments for voltage and current measurement, control, balancing and damping forces of instruments, D Arsonval galvanometer- construction and operation, PMMC (Permanent magnet moving coil), moving iron, dynamometer type instruments. Electrostatic and induction type instruments. Use of rectifier for measuring instruments.

UNIT-III

Extension of range of voltmeter and ammeter. Current transformer (CT) and Potential transformer (PT) - theory, ratio and phase angle error, design considerations, characteristics, effect of power factor, secondary burden. Industrial current sensors (Hall Effect)

UNIT-IV

Power in ac circuits, construction and operation of dynamometer and induction type wattmeter. Measurement of power using wattmeter for single phase circuits and three phase circuits. Measurement of reactive power.

UNIT-V

Measurement of energy- single phase induction type watt-hour meter and clock meters. Polyphase watt-hour meters. Ac energy meter testing. Meters for special purposes- prepayment meters, maximum demand indicator, power factormeter, frequency meter and synchroscope.

Books Recommended

- 1.W D Cooper, A D Helfric, "Electronic Instruments and Measurements", Prentice Hall of India, New Delhi.
- 2.E W Golding and F C Widdis, " Electrical Measurements and Measuring Instruments", JOBS Publications.
- 3.A.K.Sawhney, "A Course in Electrical and Electronic Instruments and Measurements", DhanpatRai and Sons, Delhi.

EE-503T -Microprocessors

L P

3 0

UNIT I

8085 pinout diagram, function of different pins, data bus, address bus, multiplexing and demultiplexing of address/data lines, control bus, control and status signals, internal architecture (ALU, Register Array, timing and Control Unit), flags, basic interfacing devices (buffers, tristate devices, decoders, encoders, latches), Memories (ROM, RAM & their types).

UNIT II

Different addressing modes, instruction set, arithmetic and logic operations, 8085 assembly language programming, (addition, subtraction, multiplication, Division), timing diagrams, Instruction cycle.

UNIT III

Addressing techniques, memory mapped I/O and I/O mapped I/O scheme, Partial and absolute address decoding, Basic interfacing concepts, interfacing input devices, interfacing output devices, 8085 Interrupts, stack and subroutines, counters and time delays.

UNIT IV

Interfacing peripheral devices, Multi-purpose programmable device (8155), Interfacing of different devices , stepper motor, A/D and D/A converters, Programmable peripheral interface (8255) and its interfacing with 8085, Interfacing with LCD, 8259A programmable interrupt controller, Direct memory access and DMA controller (8237), The 8254 programmable interval timer

UNIT V

8086 architecture, addressing modes, Instruction set, Basic programming concepts,interrupts.

Books Recommended:

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and Applications with 8085. PRI Publishing (India) Pvt. Ltd.
2. Gilmore, Microprocessors, TMH India.
3. K.L. Short, Microprocessors and Programming Logic
4. M. Rafiqzaman, Microprocessors: Theory and Applications (Intel and Motorola)

EE- 504T-Communication Systems

L P
3 0

UNIT-I

Evolution, introduction and benefits of communication technology, Classification of signals (deterministic & non-deterministic signals, even & odd signals) Signal Spectrum: Fourier series analysis of periodic signals, Fourier transform. Amplitude spectrum of signals, power spectrum of signals, Modulation & Need for modulation

Amplitude modulation (AM): definition, AM modulation index, spectrum of AM signal, power analysis of AM signal, Standard AM generation, detection using envelop detector. DSB/SC-AM, Generation & detection of SSB-SC modulation, Vestigial Side band A M signal (Brief ideas).

UNIT-II

Frequency modulation (FM): Basic definition, Frequency modulation index, Carson Bandwidth of FM signal, Narrow band and broad band FM signal. Generation of FM, Detection of FM, pre-emphasis, de-emphasis, FM threshold effect

UNIT-III

Elements of digital communication systems, advantages of digital communication systems, Elements of PCM : Sampling, Quantization and Coding, Quantization error (proof not required), Differential PCM systems(DPCM), Delta modulation, its drawbacks, adaptive delta modulation, comparison of PCM and DM systems. Digital Modulation techniques, ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-ary PSK, ASK, FSK. Similarity of BFSK and BPSK, Base band signal receiver, the optimum filter, matched filter, probability of error using matched filter, coherent reception, non-coherent detection of FSK.

UNIT-IV

Frequency division multiplexing (FDM), Tuned radio frequency receiver, heterodyne receiver, image frequency, Pulse modulation Techniques-Pulse Amplitude modulation (PAM), Pulse Position Modulation (PPM) Pulse Width Modulation (PWM).

UNIT-V

Definition of noise, sources of noise, Noise power, White noise, Band limited white noise, signal to noise ratio, SNR of base band communication system, SSB, DSB/SC, Standard-AM, SNR of FM, Noise figure, Relative performance.

Books Recommended:

1. Principles of communication system, Taub and Schilling, Mcgraw Hill, 3rd Ed.
2. Communication system; Analog and Digital, Sanjay Sharma
3. Modern Analog and Digital Communication system by Lathi
4. Communication System by Simon Hykin
5. Electronic Communications, Roody- Coolan, PHI

EE-505T - Mathematics-V

L P
4 0

UNIT I

Finite Difference: Difference Table and its usage. The difference operators Δ , ∇ and the operator E . Interpolation: Interpolation with equal intervals, Newton's advancing difference formula. Newton's backward difference formula. Interpolation with unequal intervals. Newton's divided difference formula. Lagrange's interpolation formula.

Central Differences: The central difference operator δ and the over-ranging operator μ . Relations between the operators. Gauss forward and backward interpolation formula, Sterling's, Bessel's, Laplace and Everett's formulae.

UNIT II

Inverse interpolation: Inverse interpolation by (i) Lagrange's (ii) Methods of successive approximation & (iii) Methods of elimination of third differences

Numerical solution of algebraic and Transcendental Equations: Graphic Method, Regula-Falsi method, Balzano's Process of bisection of intervals, Newton-Raphson Method and its geometrical significance.

UNIT III

Numerical Integration: Numerical Integration, General Quadrature Formula, Simpson's one-third and three-eighths rules, Weddles' rule, Hardy's rule, Trapezoidal rule.

Numerical differentiation : Numerical differentiation of a function. Differential coefficient of a function in terms of its differences. Applications

UNIT IV

Difference Equations: Linear-homogeneous and non-homogeneous difference equations of order n with constant coefficient, and their solution, methods of undetermined coefficient.

UNIT V

Numerical Solution of ordinary differential equations: Numerical solution of ordinary differential equations, Picard's method. Taylor's series method, Euler's method, Runge-Kutta Method.

Books Recommended:

1. Numerical Methods for Scientists and Engineering by M.K.Jain, S.R.Iyengar & R.K. Jain, Wiley Eastern Ltd.
2. Mathematical Numerical Analysis by S.C. Scarborough, Oxford and IBH publishing Company.
3. Introductory methods in Numerical Analysis by S.S.Sastry, Prentice Hall of India.
4. Numerical Solution of Differential equations by M.K.Jain

EE – 506P–Electrical Machines-II Lab

L P
0 3

List of Experiments:

1. To study the different parts of an Induction motor.
2. To determine the equivalent-circuit parameters of a 3-phase Induction motor by (i) No load test (ii) Blocked rotor test
3. To determine the Torque / speed characteristics of a 3-phase Induction motor
4. To determine the equivalent circuit parameters of a 1-phase Induction motor by (i) No load test (ii) Blocked rotor test
5. To Study of the construction of a synchronous machine
6. To obtain the OCC and SCC of a synchronous machine by Synchronous impedance method
7. To find voltage regulation of an alternator by actual loading
8. To obtain the V-curves and inverted V-curves of a synchronous motor

EE – 507P– Electrical measurement and Instrumentation Lab

L P

0 3

List of Experiments:

1. Calibration of ac voltmeter and ac ammeter.
2. Measurement of form factor of a rectified sine wave and determine source of error if r.m.s.value is measured by a multi-meter.
3. Measurement of phase difference and frequency of a sinusoidal ac voltage using C.R.O.
4. Measurement of power and power factor of a single phase inductive load and to study effect of capacitance connected across the load on the power factor.
5. Measurement of low resistance by Kelvin's double bridge.
6. Measurement of voltage, current and resistance using dc potentiometer.
7. Measurement of inductance by Maxwell's bridge.
8. Measurement of inductance by Hay's bridge.
9. Measurement of inductance by Anderson's bridge.
10. Measurement of capacitance by Owen's bridge.
11. Measurement of capacitance by De Sautybridge.
12. Measurement of capacitance by Schering bridge

EE-508P - Microprocessors Lab

L P
0 3

List of Experiments:

1. To write a program to add two single byte numbers.
2. To write a program to subtract one 8-bit number from another 8-bit number.
3. To write a program to multiply two single byte numbers.
4. To write a program to divide one number by another.
5. Write a program to introduce a time delay using subroutine.
6. Write a program to find the greatest of three numbers
7. To write a program to read data from an input device and send its complement to output.
8. To write a program to rotate a stepper motor both in clockwise and anti-clockwise direction
9. To design and interface a circuit to read data from analog to digital convertor, using 8255A in the memory-mapped I/O.
10. To design and interface a circuit to convert digital data into analog signal, using 8255A in the memory-mapped I/O.

6thSemester

Course Code	Course Title	L – P	Credit
EE 601T	Power Systems-I	4 – 0	4
EE 602T	Power Electronics	4 – 0	4
EE 603T	Digital Signal Processing	4 – 0	4
EE 604T	Control System-II	3 – 0	3
EE 605T	Design of Power Apparatus	4 – 0	4
EE 606P	Power System-I Lab	0 – 3	2
EE 607P	Power Electronics Lab	0 – 3	2
EE 608P	Control System-II Lab	0 – 3	2
	Total Credits	19 - 9	25

EE - 601T –Power System-I

L P
4 0

UNIT I

Introduction to Power System, Single line diagram, impedance and reactance diagram of a power system, Single Phase and Three Phase Transmission, Overhead and Underground transmission System, Elements of AC distribution. Single fed, double fed and ring main distributor. Per unit Systems.

UNIT II

Mechanical design of transmission line. Types of insulators and their applications. Potential distribution over a string of insulators, String efficiency & methods of equalizing potential drop.

UNIT III:

Classification of cables, Cable conductors, insulating materials, insulation resistance, electrostatic stress, grading of cables, Capacitance calculation, losses and current carrying capacity.

UNIT IV

Transmission line parameters, types of overhead conductors with calculations of inductance and capacitance, effect of earth on capacitance of a transmission line, Bundled conductors, Skin and proximity effect, corona, interference of power lines with communication lines.

UNIT V

Representation of lines, Modelling and Performance analysis of short, medium and long transmission lines. ABCD constants, Transposition of transmission conductors, Surge impedance loading., Ferranti effect.

Books Recommended:

1. Power System Analysis J.J. Grainger and W.D Stevenson McGraw hill 1994
2. Electric Power Systems C.L. Wadhwa New age international 2010
3. Power System Engineering Nagrath and Kothari Tata McGraw hill 2007
4. Transmission and Distribution of Electrical Energy H.CottonHodderArnold 3rd Revised edition

EE - 602T –Power Electronics

L P
4 0

UNIT I:

Introduction to Power Electronics and Power Semi-conductor Devices: Characteristics and Specification of switches - Ideal characteristics, Characteristics of Practical Devices, Switch specifications, Figures of merit, Power Semiconductor devices, basic theory of operation (Power Diodes, BJTs, Power MOSFETs, IGBTs, GTOs) SCR: Characteristics, Two-transistor model , protection, Firing. Recent Advances in Power Semiconductor Devices.

UNIT II:

AC-DC Converters AC-DC uncontrolled converters-Single phase Half wave Rectifiers, Concept of freewheeling, Single phase Full wave rectifiers, Three phase bridge rectifiers, Effect of source impedance.

AC-DC controlled converters-Single phase controlled converters (Semi-converters, full converters), Analysis for different types of load, Three phase controlled converters (Semi- converters, full converters), Analysis for different types of load.

UNIT III:

DC-DC converters Introduction- Control of DC-DC converters Buck, Boost and Buck-Boost chopper configurations- Continuous and Discontinuous conduction mode, output voltage ripple.

UNIT IV:

Inverters Introduction-Principle of operation and classification (VSI and CSI), Performance parameters. Single phase inverters ,Three phase inverters, PWM control-performance of square wave inverters, Single-pulse-width modulation, Multiple-pulse-width modulation, Sinusoidal-pulse- width modulation. Current-Source Inverters.

UNIT V:

AC Voltage Controllers Introduction-Principle of AC voltage control (On-Off control, Phase control) Single-Phase controllers (Analysis for different types of load)-evaluation of performance parameters cycloconverter (1-phase)

Books Recommended:

1. Power Electronics: Converters, Applications, and Design, 3rd Edition. Mohan, Ned, Undeland, Robbins, John Wiley.
2. Power Electronics: Circuits, Devices and Applications, 3rd Edition. M. H. Rashid, Prentice Hall.
3. Power Electronics, 3rd Edition, Lander Cyril W, McGraw-Hill.
4. Power Electronics, Dr. P.S. Bimbhra, Khanna Publishers

EE - 603T –Digital Signal Processing

L P
4 0

UNIT I

Basic elements of digital signal Processing –Concept of frequency in continuous time and discrete time signals –Sampling theorem –Discrete time signals. Discrete time systems –Analysis of Linear time invariant systems –Z transform –Convolution.

UNIT II

Introduction to DFT – Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Use of FFT algorithms in Linear Filtering and correlation.

UNIT III

Structure of IIR – System Design of Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance. Bilinear transformation – Approximation derivatives – Design of IIR filter in the Frequency domain.

UNIT IV

Symmetric & Anti-symmetric FIR filters – Linear phase filter – Windowing technique – Rectangular, Kaiser Windows – Frequency sampling techniques – Structure for FIR systems.

UNIT V

Quantization noise – derivation for quantization noise power – Fixed point and binary floating point number representation – comparison – over flow error – truncation error – co-efficient quantization error - limit cycle oscillation – signal scaling – analytical model of sample and hold operations – Application of DSP – Model of Speech Wave Form – Vocoder.

Books Recommended:

1. A.V Oppenheim and R. W Schafer: Discrete Time Signal Processing.
2. John G. Proakis and D.G Manolavis: Digital Signal Processing Principles, Algorithms and Applications.
3. J.R Johnson : Introduction To Digital Signal Processing.
4. L.R Rabinder and B. Gold :Theory and Application of Digital Signal Processing.

EE - 604T –Control System-II

L P
4 0

UNIT I:

Control system analysis using State Variable methods Introduction to the State variable representation; Conversion of State variable models to transfer functions and vice-versa; Eigen values and Eigen vectors; Solution of state equations; Properties of state transition matrix- computation of state transition matrix by Laplace transformation and Cayley-Hamilton theorem; Concepts of Controllability and Observability.

UNIT II:

Analysis of Discrete-time Control Systems Introduction to Discrete-time control systems; Basic Discrete-time signals; State space representation of Discrete-time systems; Difference equation models; The z transform; The Pulse transfer function; s-Plane to z-Plane mapping, Stability on the z-plane and the Jury Stability criteria; Mathematical modeling of Impulse sampling and data hold.

UNIT III:

Control System design using State variable methods Introduction, State variable feedback structure; Pole-placement design using state feedback; Limitations of State Feedback; State feedback with Integral control, Observer-based state feedback control; Control design of discrete-time systems using state feedback.

UNIT IV:

Introduction to Optimal control Introduction, formation of optimal control problem, calculus of variations minimization of functions, constrained optimization. Pontryagin's Minimum Maximum Principle, Linear Quadratic Problem-Hamilton Jacobi equation, Riccati equation and its solution.

UNIT V:

Nonlinear Control Systems Non-linear Systems: Types of non-linearities, phenomena related to non-linear systems. Analysis of non-linear systems: linearization, phase portraits, describing function method and feedback linearisation. Stability: Lyapunov's stability theorems for continuous time systems.

Books Recommended:

1. M.Gopal, Digital Control and State variable Methods.
2. Stefani R., Savant C., Shahian B., Hostetter G., Design of Feedback Control Systems
3. Discrete-time systems, K. Ogata.
4. Optimal Control Systems, D.S. Naidu.
5. Applied nonlinear control, Jean-Jacques Slotine, Weiping Li .Unit I: State variable modeling.

EE - 605T –Design of Electrical Machines

L P
4 0

UNIT I

Considerations in design, design factors, limitations in design, modern trends in design. Magnetization curves, Magnetic leakage, calculation of mmf for air gap and teeth, effect of saliency.

UNIT II

Winding design, Integrated approach for windings, A.C armature windings, production of emf in windings, Mmf distribution of armature windings, eddy current losses in conductors.

UNIT III

Output equation, Main dimensions, Armature design, Armature windings, Design of commutator and brushes, Design of Field systems, Design of interpoles.

UNIT IV

Output equation, core design, winding design, yoke design, Design of transformer tank with tubes, design of insulation.

UNIT V

Output equation, main dimensions, Stator winding, stator conductors, shape of stator slots, number of stator slots, stator core, rotor design (squirrel cage and wound rotor)

Books Recommended:

1. Electric Machine Design by A.K. Sawhney
2. Design of Electrical Machines by Mittle and Mittla
3. Electrical machine Design by R.K. Agarwal

EE – 606P–Power System-I Lab

L P
0 3

List of Experiments:

1. To study different types of insulators
2. To study potential distribution across different units of a string of insulators with and without guarding.
3. To study different parts of a power cable.
4. To measure the insulation resistance of a cable.
5. To determine the charging current of a cable.
6. To study different types of overhead conductors.
7. To determine ABCD parameters of a transmission line.
8. To determine voltage regulation and efficiency of a transmission line.
9. Study of Ferranti effect.

EE – 607P–Power Electronics Lab

L P
0 3

List of Experiments

1. V-I static characteristics of Thyristors.
2. UJT characteristics.
3. Study the operation of a Line Synchronized UJT Relaxation Oscillator.
4. Various triggering methods of SCRs.
5. Protection circuits of SCRs.
6. Various techniques of forced commutation of SCRs.
7. Different types of diode rectifiers (Analysis for different types of loads).
8. Different types of controlled rectifiers (Analysis for different types of loads).
9. Operation of a Buck converter.
10. Operation of a V.S.I.
11. Operation of AC voltage controllers (Analysis for different types of loads).

EE – 607P–Control System-II Lab

L P
0 3

List of Experiments

1. Experimental demonstration of various concepts of control system design (controllers and observers) using state space methods.
2. Digital Control system analysis and design.
3. Microprocessor based control.
4. Demonstration of nonlinear control on standard problems like inverted pendulum etc.
5. Experiments on system identification.
6. Control system analysis and design using MATLAB / SIMULINK.

7thSemester

Course Code	Course Title	L – P	Credit
EE 701T	Power System-II	4 – 0	4
EE 702T	Power System Protection	3 – 0	3
EE 703T	Microcontroller & Applications	4 – 0	4
EE 704T	Industrial Management	3 – 0	3
EE 705T	Electrical Drives	3 – 0	3
EE 706P	Power System-II Lab	0 – 2	1
EE 707P	Power System Protection Lab	0 – 2	1
EE 708P	Electrical Drives Lab	0 – 2	1
EE 709P	Preliminary Project Work/ Seminar	0 – 4	2
EE 710P	Practical Training		2
DIC E01P	Microcontroller based system Design (Optional)	0 - 6	3
	Total Credits	17 - 10	24 + 3

EE - 701T –Power System-II

L P
4 0

UNIT I

Transients in simple circuits, Three phase short circuit on an alternator, Restriking Voltage after removal of short circuit, Traveling waves on transmission lines: open-end line, short-circuited line, line terminated through a resistance.

UNIT II

Faults, types of faults: Symmetrical & Unsymmetrical , Analysis of Symmetrical faults, Symmetrical components of a three phase system, Evaluation of components, Three phase power in terms of symmetrical components, Sequence impedances.

UNIT III

Introduction, Sequence network equations, calculation of fault currents for unsymmetrical faults: single line to ground, line-to-line, double line to ground faults and for symmetrical 3-phase balanced faults, current limiting reactors.

UNIT IV

Power System Stability, Transient and Steady State stability, Power angle equation, Swing equation, Equal area criterion of Stability, Critical clearing angle, Factors affecting transient stability. Real and reactive power control.

UNIT V:

Load flow analysis: Introduction, bus classifications, nodal admittance matrix (Y BUS), development of load flow equations, load flow solution using Gauss-Siedel and Newton-Raphson method, approximation to N-R method.

Books Recommended:

1. Power System Analysis by J.J. Grainger and W.D Stevenson
2. Electric Power Systems by B.M. Weedy and Cory
3. Power Systems Engineering by Nagrath and Kothari
4. Electrical Power Systems by C.L. Wadhwa

EE - 702T – Power System Protection

L P
3 0

UNIT I

Function of protective relaying, fundamental principles, primary and backup relaying, functional characteristics. Operating principles and characteristics of the following electromechanical relays: Current, voltage, directional, current balance, voltage balance, differential relays, and distance relays.

UNIT II

Short-circuit protection of stator windings, protection against turn-to-turn fault, stator ground-fault protection, stator open circuit protection, Overheating protection, Overvoltage protection, Loss of excitation protection, rotor overheating protection, Protection against vibration, protection against motoring over speed protection, Short circuit protection, over current and earth-fault protection differential protection. Use of biased relay for differential protection, self balance system protection, differential magnetic balance protection, Buchholz relay, protection of parallel transformer banks, etc.

UNIT III

Protection of feeders, time limit fuse, over current protection for radial feeders, protection of parallel feeders, differential protection for parallel feeders, protection of ring mains, differential pilot wire protection, Circulating current protection, protection for bus-bars, frame leakage protection, differential protection, for bus bars, protection for double bus-bar system, transmission line protection, using over-current relays, using distance relays. Setting of over-current and distance relays, coordination of relays. Phase fault and earth fault protection.

UNIT IV

Types of circuit breakers, basic principle of operation, phenomena of arc, initiation of arc, maintenance of arc, arc extinction, DC circuit breaking, AC circuit breaking, arc voltage and current waveforms in AC circuit breaking, restriking and recovery voltages, de-ionization and current chopping, ratings of circuit breakers.

UNIT V

Fusing element, classification of fuses, current carrying capacity of fuses, high rupturing capacity (H.R.C.) cartridge fuses, characteristics of H.R.C. fuses, selection of HRC fuses.

Books Recommended:

1. Art and Science of Protective Relaying by Mason.
2. Protective relaying, Principles and Applications by J. L Black Burn
3. Computer Relaying for Power Systems, by A.G. Phadke and J.S Thorp. (John Wiley and sons New York 1988).

EE - 703T – Microcontroller & its Applications

L P
4 0

UNIT I

Introduction: Overview of Embedded System, Categories of Embedded System, Microcontroller and Embedded Processors, System and Processor Architecture: von Neumann, Harvard and their variants, Microcontroller Architecture: Overview of 8051 Microcontroller family: Architecture, basic assembly language programming concepts, The program Counter and ROM Spaces in the 8051, Data types, 8051 Flag Bits and PSW Register, 8051 Register Banks and Stack Instruction set, Loop and Jump Instructions, Call Instructions,

UNIT II

Timers: Time delay generations and calculations, I/O port programming Addressing Modes, accessing memory using various addressing modes, Arithmetic instructions and programs, Logical instructions, Single-bit instruction programming, Programming of 8051 Timers, Counter Programming

UNIT III

Communication with 8051: Basics of Communication, Overview of RS-232, I2C Bus, UART, USB, 8051 connections to RS-232, 8051 serial communication programming, 8051 interrupts, Programming of timer interrupts, Programming of External hardware interrupts, Programming of the serial communication interrupts, Interrupt priority in the 8051

UNIT IV

Interfacing with 8051: Interfacing an LCD to the 8051, 8051 interfacing to ADC, Sensors, Interfacing a Stepper Motor, 8051 interfacing to the keyboard, Interfacing a DAC to the 8051, 8255 Interfacing with 8031/51, 8051/31 interfacing to external memory

UNIT V

Data Converters: Data converter fundamentals, Digital-to-Analog Converter (DAC) Specifications, Analog-to-Digital Converter (ADC) Specifications, DAC architectures, ADC architectures

Books Recommended

1. Raj Kamal, "Embedded Systems", TMH, 2004.
2. M.A. Mazidi and J. G. Mazidi, "The 8051 Microcontroller and Embedded Systems", PHI, 2004
3. David E. Simon, "An Embedded Software Primer", Pearson Education, 1999.
4. K.J. Ayala, "The 8051 Microcontroller", Penram International, 1991.
5. Dr. Rajiv Kapadia, "8051 Microcontroller & Embedded Systems", Jaico Press
6. Dr. Prasad, "Embedded Real Time System", Wiley Dreamtech, 2004.

EE - 704T – Industrial Management

L P
3 0

Unit I

Industry, meaning of Industrialization, Industrial revolution, Need problems and prospectus of Industrial change in the developing countries, Industrial Evolution in India, Downfall of early Industries, Evolution of modern Industry, Effects of partition, Industrial policy and progress after independence.

UNIT II

Concept and Techniques- Nature, scope and role of economics. Theory of demand and supply, substitutions effect elasticity of demand, production and cost- the production function, economics of scale: Estimating the production

UNIT III

Theory of firm-profit maximization, sale maximization wealth maximization. Market structure-perfect competition, imperfect competition

UNIT IV

Nature, scope and types of marketing, marketing environment, strategic marketing palnning, Marketing information system and marketing research.Market segmentation, targeting and positioning, product decisions-.

Unit V

Product mix, product life cycle ,new product development, branding decisions(Basis), pricing – objectives, channel, management-channel type

Books Recommended:

- 1 William H. Shaw, Business Ethics.
- 2 MarIUelG.Valesquez, (1998). Business Ethics, Pearson Education
3. Drucker P Panbooks (2000). Managing in Turbulent times London:
- 4Boatright J. R, (1999) Ethics and Conduct of Business Pearson Education
5. Enis,B.M. Marketing Classics: (1991). A Selection of Influential Articles, New York, McGraw Hill,
6. Kotler, Phillip and Armstrong, (1997). G. Principles of Marketing, New Delhi,Prentice Hall of India.
7. Ramaswamy,V.S and Namakumari,(2000). S. Marketing Management Planning, Control. New Delhi.

EE - 705T – Electrical Drives

L P
3 0

UNIT I

Definition of Electric Drive, Structure and Elements of an Electric Drive, classification of Electric Drives Advantages of Electrical Drives. Types of Loads, Quadrant Diagrams, Four quadrant operation, Power requirement of different loads, Drive specifications.

UNIT II

Multi-Quadrant operation of separately-excited D.C Motor with regenerative braking, Transfer functions of separately excited D.C Motor, Single-phase converter-fed separately excited D.C Motor Drives, Mathematical Analysis and Torque/speed characteristics, performance evaluation (in Continuous Conduction Mode and Discontinuous Conduction Mode), Methods of improving the performance of DC Motor Drives, Three-phase converter fed DC Motor Drives (in Continuous Conduction Mode and Discontinuous Conduction Mode),

UNIT III

Motoring and regeneration operation of chopper-fed separately-excited DC Motor Drive, Chopper-fed series motor drive, Dynamic braking, Composite braking, Two quadrant and Four quadrant operation of chopper-fed DC Motor Drives

UNIT IV

3-phase AC voltage controller-fed Induction Motor drive, voltage source inverter (VSI) and current source inverter (CSI) variable frequency drives, comparison of VSI and CSI drives, Cyclo-converter fed Induction Motor drive, static rotor resistance control of 3-phase slip ring Induction Motor.

UNIT V

Control of synchronous Motor: Self-controlled synchronous motor, vector controlled synchronous motor, Permanent Magnet Synchronous Motor Drive, Brushless DC Motor Drive, Switched Reluctance Motor (SRM) Drive.

Books Recommended:

1. Power Semi-conductor controlled Drives by G.K. Dubey (Prentice Hall)
2. Thyristor D.C Drives by P.C Sen
3. Power Electronic Control of A.C Motors by Murphy & Turnbull
4. Power Electronics and A.C Drives by B.K. Bose
5. An Introduction to Electrical Drives by G.K. Dubey.

EE – 706P–Power System-II Lab

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List of Experiments:

1. To measure positive, negative and zero sequence reactance of synchronous machine
2. Measurement of positive, negative and zero sequence impedance and currents.
3. Measurement of earth resistance.
4. Transmission line fault analysis
5. To Study The Single Line To Ground Fault
6. To Study Line To Line Fault
7. MATLAB/SIMULINK application in power system.

EE – 707P – Power System Protection Lab

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List of Experiments/ Field Visits:

1. Study of various types of relays.
2. Characteristics of fuses of different relays.
3. Characteristics of inverse time over current relays.
4. Time graded protection using inverse time O/C relays
5. Visit to an Electric Sub-station to study various protective schemes.
6. Study of circuit breakers.
7. Study of differential protection scheme.
8. Study of an oil circuit breaker.
9. Operating quantity versus polarizing quantity characteristic of a directional attracted armature relay.
10. To study I.D.M. T. Over current relay (electro mechanical type)
11. To study Percentage Differential Relay
12. To study the instantaneous relay and determine the pick up and reset values.
13. To study Thermal Relay & Fuse Characteristics
14. To study the earth fault relay or over current relay determine the characteristics.

EE – 708P – Electrical Drives Lab

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List of Experiments:

1. Operation of 3- phase Full-Converter on R & R-L load.
2. Performance & speed control of D.C. drive using 3-phase full Converter.
3. Performance & Operation of a four quadrant Chopper on D.C. Drive
4. Performance & Operation of a 3-phase A.C. Voltage controller on motor load.
5. Single Phase IGBT based PWM Inverter on R & R-L load
6. Operation of 3-phase IGBT based PWM Inverter on R & R-L load.
7. Performance & speed control of 3 phase slip ring Induction motor by Static Rotor Resistance controller.
8. Three phase PWM Pulse generation using PIC Micro controller
9. PIC Microcontroller based speed control of three phase Induction Motor
10. DSP based V/F Control of 3 phase Induction motor.

EE – 709P – Preliminary Project work/Seminar

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EE – 710P – Practical Training

8th Semester

Course Code	Course Title	L – P	Credit
EE 801T	Advanced Power Electronics	4 – 0	4
EE 802T	Power Station Practice	4 – 0	4
EE 803TE	Elective-I	4 – 0	4
EE 804TE	Elective-II	4 – 0	4
EE 805P	Project	0 – 18	12
	Total Credits	16- 18	28

List of Electives
Power Systems Transients
EHV AC & DC Transmission
Flexible AC Transmission Systems
Stand Alone Power System
Optimization Techniques
High Voltage Engineering
Selected Topics in Advanced Control
Optimal Control
Advanced Electrical Drives
Fuzzy Logic & Neural Networks
Industrial Process Control

EE – 801T – Advanced Power Electronics

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Unit I

Non-isolated DC-DC converters: Cuk, SEPIC, ZETA converters in DCM and CCM. Isolated DC-DC converters: Flyback, Forward, Cuk, SEPIC, ZETA, Push-Pull, Half-Bridge and Full-Bridge converters in DCM and CCM. Self power factor correction (PFC) properties of DC-DC converters at the mains of single-phase

Unit II

Single-phase Improved Power Quality AC/DC Converters: Buck, Boost, Buck-Boost, PWM VSC, PWM CSC, Multi-level converters. Three-Phase Improved Power Quality AC/DC Converters, VSC, CSC, Multi-phase converter

Unit III

Power Quality mitigation apparatus: Passive filters, Active Power Filters (APFs) and Hybrid filters DTSTCOM (Distribution Static Compensator), DVR (Dynamic Voltage Restorer) and UPQC (Unified Power Quality Conditioner).

Unit IV

FACTS Devices: TCR (Thyristor Controlled Reactor), TSC (Thyristor Switched Capacitor), STATCOM (Static Synchronous Compensator), SSSC (Static Series Synchronous Compensator), UPFC (Unified Power Flow Controller) and IPFC (Interline Power Flow Controller).

Unit V

HVDC systems: Evolution of HVDC system, Comparison of HVDC and HVAC systems, 12-pulse converter-based HVDC system, Analysis of HVDC converters, HVDC system control features, Smoothing reactor and DC lines, Reactive power requirements, Harmonic analysis, Filter design, Converter mal-operation like misfiring and commutation failure.

Books Recommended:

- 1 Power Electronics Converters, Applications, and Design by Mohan, Undeland, Robbins Wiley Indian Edition (3/e)
- 2 Power Electronics by M. H. Rashid
- 3 Power Electronics and Motor Drives: Advances and Trends by Bimal K. Bose Academic Press
- 4 FACTS Controllers by Hingorani
- 5 IEEE Transactions on Power Electronics & Industrial Electronics

EE – 802T – POWER STATION PRACTICE

L P

4 0

Unit I

Overview of different types of power stations and their auxiliaries: Thermal power plants, hydroelectric stations, nuclear power stations, diesel power stations, gas turbine plants.

Power generation terms: Connected load, Maximum Demand, Demand Factor, Load factor, Diversity factor, Load duration curve, Number and size of generator units, base load and peak load plants.

Unit II

Economics of generation, factors affecting the cost of generation, reduction of costs by interconnection of stations, curves useful in system operation, choice of size and number of generating units. Power factor, disadvantages of low power factor, methods of improving power factor, location of power factor improvement apparatus

Unit III

Tariffs in Electrical energy, factors influencing the rate of tariff, designing tariff, different types of tariff, flat rate tariff, block rate tariff, two part tariff, maximum demand tariff, power factor tariff.

Unit IV

Neutral grounding, solid grounding, resistance grounding, reactance grounding, arc suppression coil grounding, earthing transformers, choice of methods of neutral grounding equipment, grounding for safety. Maintenance schedule of various electrical equipments: Alternators, Transformers, Circuit Breakers.

Unit V

Introduction, classification of substations, equipments for substations, selection and location of site for substation, Key diagram of typical substations, substation auxiliary supply, substation earthing.

Books Recommended:

1. Electric power stations by Car.
2. Electric power system control by H.P. Young.
3. Elements of Power Station design by M.V. Deshpande (3rd Edition, New Delhi, Wheeler Publication Co. Ltd. 1997).
4. Generation of Electrical Energy by B.R.Gupta (3rd Edition, New Delhi , EURASIA Publication House).

EE – 803TE – Elective-I

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Students will choose any one subject from the given list of electives.

EE – 804TE – Elective-II

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Students will choose any one subject from the given list of electives.

EE – 805P – Project

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Syllabus of Electives

POWER SYSTEM TRANSIENTS

UNIT I

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

UNIT II

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression-current chopping - effective equivalent circuit. Capacitance switching, Ferro resonance.

UNIT III

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

UNIT IV

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

UNIT V

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

Books Recommended:

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Interscience, New York, 2nd edition 1991.
2. R.D.Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.
3. M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, 2nd edition, 2000.

EHV AC AND DC Transmission

UNIT I

Introduction-Necessity for EHV Transmission-Problems involved in EHV Transmission-Operational Aspects of EHV power transmission-Compensation of EHV systems-Gas insulated EHV lines-Environmental and biological aspects.

UNIT II

Standard Voltage levels for Transmission lines-Hierarchical levels of Transmission Network-Average values of line parameters-Power handling capacity and line losses-Cost of Transmission line and Equipments-Mechanical consideration in line performance-Comparison of Overhead and Underground lines.

UNIT III

Power Transferability of Ac line – Line losses-Conductor cost -Transient stability of Ac line – control of power flow through line Right – of- way (Row)-Corona-Towers (support)-Insulation Coordination and surge arrester protection-Line insulation-Clearance and Creepage distances.

UNIT IV

Choice of HVDC Transmission - Comparison of AC and DC Transmission –Economics of DC power Transmission, Technical Performance and Reliability –Description of HVDC Converter station- Types of HVDC Links- Merits and Limitations of HVDC System - Applications -Modern Trends in HVDC transmission–Case Studies of HVDC links in the world.

UNIT V

Pulse number – Choice of Converter Configuration – Simplified analysis of Graetz circuit – Principles of HVDC link Control –DC Breaker - Harmonic Elimination – AC and DC Filter design –Protection Systems in HVDC Substation-HVDC Simulator.

Books Recommended

1. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", Third Edition, New Age International (P) Limited, Publishers., 2009.
2. Padiyar. K.R "HVDC Power Transmission Systems", New Age International (P) Limited, Publishers., 2009.
3. Chakrabarti. A.M. L. Soni, P.V. Gupta, U.S. Bhatnagar, "Power System Engineering", Dhanpat Rai & Co., 2010.
4. Sunil S. Rao, "Switchgear Protection and Power Systems", Khanna Publishers, 2004.

Flexible AC Transmission Systems

UNIT I

Electrical transmission network – Need of transmission interconnections – power flow in AC systems – power flow and dynamic stability considerations – Relative importance of controllable parameters – Basic types of FACTS controllers Brief description & definitions – Benefits from FACTS technology.

UNIT II

Introduction to shunt compensation – Objectives of Shunt compensation – Voltage control by SVC – VI characteristics – advantages of slope in dynamic characteristics – Influence of SVC on system voltage, SVC applications: Steady state power transfer capacity – enhancement of transient stability – Prevention of voltage instability.

UNIT III

Introduction to series compensation – Objectives of series compensation – Operation of TCSC: Different modes of operation – Modeling of TCSC: variable reactance model, Transient stability model – TCSC applications: Improvement of system stability limit – voltage collapse prevention .

UNIT IV

Basic concept of voltage source converters and current source converter SSSC – principle of operation – Applications, STATCOM – principle of operation – VI characteristics – Applications – UPFC: - Modes of operation – Applications – Introduction to IPFC – Comparison of SVC and STATCOM.

UNIT V

Objectives of voltage and phase angle regulators — Approaches to thyristor controlled voltage and phase angle regulators – Industrial applications of FACTS devices- Case studies.

Books Recommended

1. Narain G. Hingorani and Lasz Gyugyi, "Understanding FACTS – Concept & technology of flexible AC transmission systems", Standard publishers distributors, IEEE press, 2001.
2. Padiyar. K.R, " FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, New Delhi, 2008.

Stand Alone Power Systems

Unit I

Induction generator used in stand alone power systems, self excited and grid connected induction generators, generation of power using singly fed induction generator at fixed speed and semi variable speed, and at variable speed using doubly fed induction generators.

UnitII

Introduction to wind energy, wind power density, power contained in a wind stream, wind turbine efficiency, various types of wind turbines used for power generation, horizontal and vertical axis turbines, Generation of power using wind turbines driving different generators.

Unit III

Photo voltaic (PV) technology: Present status, characteristics of PV systems, equivalent circuit, array design , building integrated PV system, its components , PV modules and arrays, impact of temperature and shading, Grid connected PV systems, Maximum power point tracking operation.

Unit IV

Wind-diesel hybrid power systems, problems of frequency and voltage fluctuations, solar- wind hybrid power systems, solar- diesel hybrid power systems.

Unit V

Role of energy storage systems in standalone power systems, energy storage systems for electrical utility peak sharing, pumped hydro energy storage plants, compressed air energy storage(CAES),CAES with gas turbine peaking power plants, battery energy storage systems, superconducting magnetic energy storage.

Books Recommended:

1. Wind Energy conversion system By Ferri.
2. Wind-Solar Power Systems by Patel.
3. Power System stability and control by Kunder.
4. Analysis of Electric Machines by P.C Kraus.
5. Dynamics & Stability of Power Systems by Padyar
6. Renewable energy technologies - R. Ramesh, Narosa Publication
7. Energy Technology – S. Rao, Parulkar
8. Non-conventional Energy Systems – Mittal, Wheelers Publication. Reference Books

OPTIMIZATION TECHNIQUES

Unit I

Introduction- Optimization problem formulation, optimization algorithms, applications and examples, different optimization methods available.

Unit II

Single Variable optimization-Optimization criteria, bracketing methods – Exhaustive search method, bound phase method; Region Elimination methods – Fibonacci search method, Golden search method; Gradient based methods – Newton Raphson method, Bisection method; Root finding using optimization technique.

Unit III

G Multi objective optimization- Optimization criteria, Different search methods, Unidirectional search, Direct search method – Evolutionary optimization method, Powell’s conjugate direction method; Gradient based methods – Newton’s method and Variable metric method.

Unit IV

Specialized Methods- Integer programming, Geometric programming, simulated annealing, Global optimization using - steep descent method, simulated annealing.

Unit V

Genetic algorithms and evolutionary approaches-Differences and similarities between genetic algorithms and traditional techniques, operators of GA’s, Computer program for simulated annealing, Newton Raphson method, Evolutionary optimization method.

Books Recommended

1. Kalyanmoy Deb, “Optimization for Engineering design”, Prentice Hall, India, 2005.
2. Kalyanmoy Deb, “Multi objective optimization using Evolutionary algorithms”, John Wiley, 2001.
3. Taha, Operations Research, TMH 2010

High Voltage Engineering

UNIT I

Causes of over voltages and their effects on power system – Lightning, switching and temporary over voltages – protection against over voltages – Insulation coordination

UNIT II

Gaseous breakdown in uniform and non-uniform fields – corona discharges – Vacuum breakdown – conduction and breakdown in pure and commercial liquids – breakdown mechanisms in solid and composite dielectrics.

UNIT III

Generation of high DC voltages - multiplier circuits – Van de Graff generator – high alternating voltage generation using cascade transformers - production of high frequency AC high voltages - standard impulse wave shapes - Marx circuit generation of switching surges - impulse current generation - tripping and control of impulse generators.

UNIT IV

HVDC measurement techniques – measurement of power frequency A.C. voltages - sphere gap measurement technique - potential divider for impulse voltage measurements – measurement of high D.C, A.C and impulse currents

UNIT V

Tests on insulators - testing of bushings - testing of isolators and circuit breakers - cable testing - testing of transformers - surge diverter testing - radio interference measurement - use of I.S for testing.

Books Recommended

1. Naidu.M.S, and Kamaraju, “High Voltage Engineering”, Tata McGraw Hill, 2009.
2. Wadhwa.C.L, “High Voltage Engineering”, Wiley Eastern Limited, 2007.
3. Kuffel.E and Abdullah. M, “High Voltage Engineering”, Pergamon Press, 2000.
4. Dieter Kind, “An Introduction to High Voltage Experimental Technique”, Wiley Eastern Limited, 1978.
5. Ravindra Arora, Wolfgang Mosh, “High Voltage and Electrical Insulation Engineering”, Wiley-VCH Publishers, 2011.

Selected Topics in Advanced Control

The contents of the course will be decided by the course instructor.

Optimal Control

UNIT I

Introduction: formulation of optimal control problems; parameter optimization versus path optimization; local and global optima; general conditions on existence and uniqueness; finite-dimensional optimization.

UNIT II

Calculus of variations: Euler-Lagrange equation; path optimization subject to equality and inequality constraints; differences between weak and strong extrema; second-order conditions for extrema.

UNIT III

The maximum principle : Pontryagin's maximum principle; optimal control with state and control constraints; time-optimal control; singular solutions; numerical methods.

UNIT IV

Hamilton-Jacobi-Bellman equation: Hamilton-Jacobi-Bellman equation, relationship with dynamic programming; sufficient conditions for optimality; synthesis of optimum state regulator systems; numerical methods.

UNIT V

Linear quadratic problems: basic finite-time and infinite-time state regulator ; spectral factorization, robustness, frequency weightings; tracking and disturbance rejection; the Kalman filter and duality.

Books Recommended:

- 1) D.S. Naidu, Optimal control systems.
- 2) D. Liberzon, Calculus of Variations and Optimal Control Theory: A Concise Introduction.
- 3) Donald Kirk, Optimal Control Theory: An Introduction.

Advanced Electric Drives

UNIT I

Generalized theory and Kron's primitive machine model.

UNIT II

Modeling of dc machines Modeling of induction machine Modeling of synchronous machine Reference frame theory and per unit system.

UNIT III

Control of Induction Motor Drive Scalar control of induction motor Principle of vector control and field orientation Sensorless control and flux observers Direct torque and flux control of induction motor Multilevel converter-fed induction motor drive Utility friendly induction motor drive.

UNIT IV

Control of Synchronous Motor Self controlled synchronous motor Vector control of synchronous motor Cycloconvert-fed synchronous motor drive Control of synchronous reluctance motor.

UNIT V

Control of Special Electric Machines Permanent magnet synchronous motor Brushless dc motor Switched reluctance motor Stepper motors and control.

Books Recommended

1. P.C. Krause, O. Wasynczuk, and S. D. Sudhoff, "Analysis of Electric Machinery", McGraw-Hill Book Company.
2. R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control", Prentice Hall.
3. P. S. Bhimbra, "Generalized Theory of Electric Machines", Khanna Publication.
4. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education.

FUZZY LOGIC & NEURAL NETWORKS

Unit I

Basic properties of Neurons, Neuron Models, Feedforward networks – Perceptrons, widrow-Hoff LMS algorithm; Multilayer networks – Exact and approximate representation, Back propagation algorithm, variants of Back propagation, Unsupervised and Reinforcement learning; Symmetric Hopfield networks and Associative memory; Competitive learning and self organizing networks, Hybrid Learning; Computational complexity of ANNs.

Unit II

ANN based control: Introduction: Representation and identification, modeling the plant, control structures – supervised control, Model reference control, Internal model control, Predictive control: Examples – Inferential estimation of viscosity an chemical process, Auto – turning feedback control,

Unit III

Introduction to Fuzzy Logic: Fuzzy Controllers: Preliminaries – Fuzzy sets and Basic notions – Fuzzy relation calculations – Fuzzy members – Indices of Fuzziness – comparison of Fuzzy quantities – Methods of determination of membership functions.

Unit IV

Fuzzy Controllers: Preliminaries – Fuzzy sets in commercial products – basic construction of fuzzy controller – Analysis of static properties of fuzzy controller – Analysis of dynamic properties of fuzzy controller – simulation studies – case studies – fuzzy control for smart cars.

Unit V

Neuro – Fuzzy and Fuzzy – Neural Controllers: Neuro – fuzzy systems: A unified approximate reasoning approach – Construction of role bases by self learning: System structure and learning algorithm – A hybrid neural network based Fuzzy controller with self learning teacher. Fuzzified CMAC and RBF network based self-learning controllers.

Books Recommended

1. Bose and Liang, Artificial Neural Networks, Tata Mcgraw Hill, 1996.
2. Kosco B, Neural Networks and Fuzzy Systems: A Dynamic Approach to Machine Intelligence, Prentice Hall of India, New Delhi, 1992.
3. Klir G.J and Folger T.A, Fuzzy sets, Uncertainty and Information, Prentice Hall of India, New Delhi 1994.
4. Simon Haykin, Neural Networks, ISA, Research Triangle Park, 1995.

INDUSTRIAL PROCESS CONTROL

Unit I

Introduction, Evolution of Process Control Concept, Definition and Types of Processes Benefits, Difficulties and Requirements of Process Control Implementation, Classification of Process Variables, Open-loop versus Closed Loop control, Feedback and Feed-forward Control Configuration.

Unit II

Introduction, Aspects of the process dynamics, Types of dynamic processes, Common systems, Mathematical Modeling, Types and Uses of mathematical modeling, Examples of mathematical modelling.

Unit III

Introduction, Classification of Controllers, Controller Terms, Discontinuous Controllers, Continuous Controllers, PID controllers, Proportional controller in closed loop, Integral controller in closed loop, Proportional-integral controller in closed loop, Proportional-derivative controller in closed loop, Proportional-integral-derivative controller in closed loop, Comparison of various controller configurations, Controller Tuning.

Unit IV

Introduction, Electronic Discontinuous controller, Electronic proportional controller, Electronic Integral controller, Electronic Derivative controller, Electronic Proportional Integral controller, Electronic Proportional Derivative controller, Electronic Proportional Integral Derivative controller, Components and Working Of Direct digital control (DDC), Benefits of DDC.

Unit V

Introduction, Cascade Control, Feedforward Control, Feedforward- Feedback control configuration, Ratio Controller

Books Recommended:

1. Process Control Instrumentation Technology C. D. Johnson; - Prentice Hall India.
2. Process Control: Principles and Applications Surekha Bhanot; - Oxford University Press