

Academic Scheme

for

B.Tech Electrical Engineering

Four Years Programme

Vetted Syllabus

(I - VIII Semesters)

(For Batch 2012)



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

Department of Electrical Engineering

Course Structure for B.Tech Electrical Engineering Batch 2012

1st Semester

Course Code	Course Title	L – P	Credit
ELE 101T	Computer Fundamentals & Introduction	4 – 0	4
ELE 102T	Basic Electrical Engineering	4 – 0	4
ELE 103T	Mathematics-I	4 – 0	4
ELE 104T	Physics-I	4 – 0	4
ELE 105T	Professional Communication	3 – 0	3
ELE 106P	Computer Fundamental Lab	0 – 2	1
ELE 107P	Basic Electrical Engineering Lab	0 – 2	1
ELE 108P	Physics-I Lab	0 – 2	1
ELE 109P	Engineering Drawing	1 – 3	2.5
ELE 110P	Engineering Workshop	0 – 3	1.5

2nd Semester

Course Code	Course Title	L – P	Credit
ELE 201T	Computer Programming & Methodology	4 – 0	4
ELE 202T	Basics of Electronics	4 – 0	4
ELE 203T	Mathematics-II	4 – 0	4
ELE 204T	Physics-II	4 – 0	4
ELE 205T	Engineering Mechanics	4 – 0	4
ELE 206T	Ethics for Engineers	3 – 0	3
ELE 207P	Computer Programming Lab	0 – 2	1
ELE 208P	Physics-II Lab	0 – 2	1
ELE 209P	Basics of Electronics Lab	0 – 2	1
Total Credits		23 – 6	26

Department of Electrical Engineering

3rd Semester

Course Code	Course Title	L – P	Credit
ELE 301T	Electronic Devices and Circuits	4 – 0	4
ELE 302T	Network Analysis	4 – 0	4
ELE 303T	Electrical Engineering Materials	4 – 0	4
ELE 304T	Electromagnetic Fields and Waves	4 – 0	4
ELE 305T	Mathematics-III	4 – 0	4
ELE 306P	Electronic Devices and Circuits Lab	0 – 4	2
ELE 307P	Electrical Workshop	0 – 4	2
ELE 308P	Introduction to MATLAB	0 – 4	2
	Total Credits	20 – 12	26

4th Semester

Course Code	Course Title	L – P	Credit
ELE 401T	Electrical Machines-I	4 – 0	4
ELE 402T	Electrical Measurements and Instrumentation	4 – 0	4
ELE 403T	Control Systems-I	4 – 0	4
ELE 404T	Digital Electronics & Logic Design	4 – 0	4
ELE 405T	Mathematics-IV	4 – 0	4
ELE 406P	Electrical Machines-I Lab.	0 – 4	2
ELE 407P	Electrical Measurements and Instrumentation Lab	0 – 4	2
ELE 408P	Control System Lab	0 – 4	2
ELE 409P	Digital Electronics & Logic Design Lab	0 – 2	1

Department of Electrical Engineering

5th Semester

Course Code	Course Title	L – P	Credit
ELE 501T	Electrical Machines-II	4 – 0	4
ELE 502T	Power Systems – I	4 – 0	4
ELE 503T	Microprocessors	4 – 0	4
ELE 504T	Communication Systems	4 – 0	4
ELE 505T	Mathematics-V	4 – 0	4
ELE 506P	Electrical Machines-II Lab	0 – 3	2
ELE 507P	Power System-I Lab	0 – 3	2
ELE 508P	Microprocessors Lab	0 – 3	2
	Total Credits	20 – 9	26

6th Semester

Course Code	Course Title	L – P	Credit
ELE 601T	Power Systems-II	4 – 0	4
ELE 602T	Power Electronics	4 – 0	4
ELE 603T	Digital Signal Processing	4 – 0	4
ELE 604T	Control System-II	4 – 0	4
ELE 605T	Design of Power Apparatus	4 – 0	4
ELE 606P	Power System-II Lab	0 – 3	2
ELE 607P	Power Electronics Lab	0 – 3	2
	Total Credits	20 - 6	24

Department of Electrical Engineering

7thSemester

Course Code	Course Title	L – P	Credit
ELE 701T	Electrical Drives	4 – 0	4
ELE 702T	Power System Protection	4 – 0	4
ELE 703T	Microcontroller & Applications	4 – 0	4
ELE 704T	Industrial Management	3 – 0	3
ELE 705T	Elective-I	4 – 0	4
ELE 706P	Electrical Drives Lab	0 – 3	2
ELE 707P	Power System Protection Lab	0 – 2	1
ELE 708P	Preliminary Project Work/ Seminar	0 – 4	2
ELE 709P	Practical Training		2
	Total Credits	19 - 9	26

8thSemester

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

Elective Subjects for 7th Semester

1. Fuzzy Logic & Neural Networks
2. High Voltage Engineering
3. Non Conventional Energy Sources

Elective Subjects for 8th Semester

1. Selected Topics in Advanced Control
2. Optimal Control
3. Power Systems Transients
4. EHV AC & DC Transmission
5. Advanced Electrical Drives
6. Flexible AC Transmission Systems
7. Power Station Practice

B-Tech Electrical Engineering

Semester-I

Course Code	Course Title	L – P	Credit
ELE 101T	Computer Fundamentals & Introduction	4 – 0	4
ELE 102T	Basic Electrical Engineering	4 – 0	4
ELE 103T	Mathematics-I	4 – 0	4
ELE 104T	Physics-I	4 – 0	4
ELE 105T	Professional Communication	3 – 0	3
ELE 106P	Computer Fundamental Lab	0 – 2	1
ELE 107P	Basic Electrical Engineering Lab	0 – 2	1
ELE 108P	Physics-I Lab	0 – 2	1
ELE 109P	Engineering Drawing	1 – 3	2.5
ELE 110P	Engineering Workshop	0 – 3	1.5
	Total Credits	20– 12	26

ELE -101T- Computer Fundamentals and Introduction

L – P

4 – 0

Unit-I

Introduction to computer systems, Exploring computers and their usage, Looking inside the computer system, Algorithms, Problem solving using a computer, parts of computers

Hardware: The CPU & storage, description of processor, Computer memory, memory organization, ROM and RAM, types of memory etc. Description of Input/Output devices, inputting data in other ways: pens, touch screen, game controllers, optical input devices

Unit-II

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-III

Operating Systems: Need for operating system (OS), types of OS ,

Computer Languages: Introduction to programming languages, Assembly language programming (ALP), Higher Level Languages (HLL).

Unit-IV

Networks, Voice & Data Communications, Introduction to Computer communication networks, Types of communication, Physical communication media.

The Internet, Internet and the world- wide- web (WWW), Communication protocols, LAN,

Unit-V

Programming fundamentals: Data types, variables, constants, operators

Programming for decisions, Algorithms, flowcharts

Books Recommended

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

Reference Books

1. Fundamentals of Information Technology, Alexis Leon & Mathews Leon,
2. Introduction to computers, Alexis Leon & Mathews Leon, Vikas publishing House.
3. Peter Norton's Computing Fundamentals, Peter Norton, Tata McGraw Hill, 2003
4. Information Technology: inside and outside, Cyganski, Pearson Education.

ELE -102T- 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

ELE -103T- 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,

Unit-II

Double points, asymptotes, curvature and tracing of curves.

Limit, continuity and differentiability of functions of several variables, chain rule, Jacobi theorem.

Unit-III

Taylor's theorem of one and two variables, extrema of functions, two or more variables using method of Lagrange's multipliers,

Ordinary differential equations, Ordinary differential equations reducible to exact differential equations, Linear differential equations, Linear differential equations and equations reducible to linear form.

Unit-IV

Linear and Non-linear differential equation, linear differential equations of second and higher order with constant and variable coefficients, Simultaneous differential equation, 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

ELE -104T- 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, Green's theorem, successive application of del operator, vector identities, problems of these concepts

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, acoustic of buildings, applications

Unit-IV

Electromagnetic Theory: Coulombs law and Gauss's theorem, calculation of electric field and potential, divergence and curl 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, Laplace and Poisson's equations, Introduction to plasma: Debye shielding, plasma parameter, plasma frequency, collision in plasma, problems

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

ELE -105T- Professional Communication

L – P

3– 0

Unit I

Communication: definition and description; types of communication; body language; barriers to Communication.

Unit II

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 III

Written communication: nature, styles and types; difference between general and technical writing; forms of technical writing; note-taking; developing perspective; paragraph writing: skills and practice; précis writing; skills and practice.

Unit IV

Report writing; structure, drafting and types; business correspondence: purpose, types of business letters; resume; proposals and invitations; emails.

Unit V

Presentation: skills and deliverance; making and answering phone calls; debating and group discussions; facing interviews.

RECOMMENDED BOOKS:

1. Battacharaya, Inderjit. An Approach to communication Skills.
2. Chaturvedi, P.D and Mukesh Chaturvedi. Business Communication, Delhi: Pearson Education,2006.
3. Day, Richard R, ed. New Ways in Teaching Reading. Illinois: TESO 1993.
4. Mohan, Krishna and Meera Banerji. Developing Communication Skills, Delhi: Macmillan,1990.
5. O' Conner, J.D. Better English Pronunciation.
6. Prasad, LM. Organisational Behaviour New Delhi: Sultan Chand & Sons, 1984.
7. Roach, Peter. English Phonetics and Phonology with Cassettes.
8. Sasikumar V.P. Kiranmai Dutt and Geetha Rajeevan. A Course in Listening and Speaking (I &II) Bangalore: Foundation books, 2006.
9. Seely, John. Writing and Speaking Delhi: OUP.
10. Sood, S C et al. Developing Language Skills, Delhi: Manohar, 1998.

ELE -106P - Computer Fundamental Laboratory

L - P

0 - 2

- 1 Exploring computers & their uses
- 2 Study of Windows applications: MS Paint etc
- 3 Word Processing
- 4 Database and spreadsheet, graphics.
- 5 Computer Architecture
- 7 Operating Systems: Windows/Linux/
- 8 Computer Networking fundamentals
- 9 Multimedia
- 10 The Internet
- 11 Programming for internet
- 12 Computer Languages
- 13 Programming basics
- 14 Programming for decisions
- 15 Project Presentation

ELE-107P - Basic Electrical Engineering Laboratory

L – P

0 – 2

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.

ELE -108P - 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

ELE -109T- Engineering Drawing

L-P

1-3

Unit I

Introduction to Engineering Drawing

Importance, role and scope of the subject. Draughting tools, principles of graphics (sheet layout, line symbol, lettering, dimensioning, concept of solid as a three dimensional object etc).

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.

Section of solids

Principle 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 III

Intersection of surfaces

Simple case of intersection of two cylinders, two prisms, cones and a cylinder with their axis being vertical, horizontal or inclined, and cylindrical solid to flat surfaces (connecting rod , end-web type and fork type)

Development of surfaces

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

Unit IV

Isometric projections

Classification of pictorial projections, Isometric projection of plane figures, prisms, pyramids, cylinders and for the given orthographic projections.

Introduction to Auto CADD

Fundamentals of 2D construction, basics of drawing lines, circles, arcs, given orthographic views and more advanced commands using Auto CADD 2006.

Books Recommende

1. Gill, P.S Engineering Drawing, S.K. Kataria and sons,
2. Bhatt, N.D Enginnering Drawing, Charotar Book Stall, Tulsi Sadan, 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.Rana M.B.Shah Engineering Drawing, Pearson Education

ELE -110P- Engineering Workshop

L – P

0 – 3

Carpentry Shop and pattern making, Various types of timber and practice boards, defects in timber seasoning of wood, wood operations and joints, exercise involving use of important carpentry tools to practice various operations and making joints

Foundry shop Introduction to moulding shop, moulds, use of cores, tools and equipments used in foundry shop, exercise involving preparation of small sand moulds and casting.

Black smithy shop Nature of work smithy, smith's tools and their uses, safety precautions in smithy, simple cases of hand forging operations, practice in sledge hammer operation etc.

Machine shop Operation and function of various machines such as lathes, planner, shaper, grinder, drilling machines etc., basics of cutting tools, operations and simple exercises on MS round billets.

Welding shop Introduction to different welding methods, welding equipments, transformers, electrodes, welding joints, welding defects and simple exercises of welding MS flat sheets.

Sheet metal shop :Shop development of surfaces of various objects, sheet metal forming and joining operation, joints, soldering and brazing, exercise involving use of sheet metal forming operations for small joints

Fitting shop :Introduction to fitting practice and tools used in fitting shop, exercise involving marking , cutting ,fittings practice, trapping practice

Books recommended

1. Raghuvanshi , B.S; A course in workshop technology, Vol I -II. Dhanpat Rai and Sons
2. Jain, R.K; Production Technology, Khanna Publishers, New Delhi
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
ELE 201T	Computer Programming & Methodology	4 – 0	4
ELE 202T	Basics of Electronics	4 – 0	4
ELE 203T	Mathematics-II	4 – 0	4
ELE 204T	Physics-II	4 – 0	4
ELE 205T	Engineering Mechanics	4 – 0	4
ELE 206T	Ethics for Engineers	3 – 0	3
ELE 207P	Computer Programming Lab	0 – 2	1
ELE 208P	Physics-II Lab	0 – 2	1
ELE 209P	Basics of Electronics Lab	0 – 2	1
	Total Credits	23– 6	26

ELE - 201T - Computer Programming & Methodology

L – P

4 – 0

Unit-I

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-II

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-III

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

Loops: The increment and decrement operators, *for* loop revisited, the *do-while* loop, designing a problem: problem, analysis, solution.

Unit-IV

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

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

Unit-V

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.

Books Recommended:

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

Reference Books

- *Problem solving and program design in C*, Hanly, Prentice Hall
- *Engineering Problem Solving with ANSI C*, Delores M. Etter, Prentice Hall
- *C Programming*, Ivor Horton, Wrox Press Limited
- *Programming with C*, Byron S. Gottfried, Tata McGraw
- *Programming in ANSI C*, E. Balagurusamy, Tata McGraw Hill

ELE - 202T – Basics of Electronics

L – P
4 – 0

Unit-I

Introduction to Semiconductors: p and n types, transport mechanism of charge carriers, electric properties, Hall effect etc. 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.

ELE - 203T - Mathematics - II

L – P

4 – 0

Unit-I

Differential Equation: Partial differential equations of first order , langrage linear equation Standard form, Partial differential equation of second and higher order, Homogenous partial differential equations with constant coefficients,

Unit-II

Non- homogenous linear differential equations. Applications of partial differential equations, 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 , skew and skew-Hermitian Matrices. Orthogonal and unitary matrices, Triangular matrices, Rank of a matrix. Equivalent matrices, elementary transformations,

Unit-V

Inverse of matrix and solution of simultaneous equation by elementary operation. Normal form, Eigen values, and eigen vectors of a matrix. Caley- Hamilton theorem,

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.

ELE - 204T – Physics - II

L – P

4 – 0

Unit-I

Quantum Mechanics & Statistical Physics: De-Broglie Hypothesis, Davison Germer experiment, wave function and its properties, expectation value, Wave Packet, Normalisation factor, Uncertainty principle. Schrödinger Equation for free Particle, Time Dependent Schrödinger Equation, Tunnelling effect, Qualitative Features of Maxwell Boltzman, Bose-Einstein and Fermi-Dirac statistics distribution, functions & their comparison (no derivation)

Unit-II

Solid State physics: Formation of energy bands in metals, semiconductors and insulators; intrinsic and extrinsic semiconductors, Fermi energy levels for doped, undoped semiconductors and p-n junction; Tunnel diode, Zener diode.
Superconductivity: Meissner Effect, Type I and Type II Superconductors, BCS theory (Qualitative only), London's equation, properties of superconductors & applications, elementary idea of Nanotechnology.

Unit-III

Interference of Light & Diffraction: Interference due to division of wave front and division of amplitude, Young's double slit experiment, Interference, Principle of Superposition, Theory of Biprism, and Interference from parallel thin films, Newton rings, and Michelson interferometer.
Diffraction: Fresnel Diffraction, Diffraction at a straight edge, Fraunhofer diffraction due to N slits, Diffraction grating, dispersive power of Grating.

Unit-IV

Special theory of Relativity and Nuclear & Particle Physics: Frames of reference, Michelson-Morley experiment, Basic postulates of special theory of relativity, Length contraction, time dilatation, Time-energy relation.
Nuclear Mass & Size, Constituents of the Nucleus, Concept of Binding Energy, Fission & Fusion, α , β & γ –decay, Elementary idea of Nuclear Models, Classification and properties of Elementary particles, Exact conservation laws, Fundamental interactions, Quark model.

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"
 - C. Kittel, "Mechanics", Berkeley Physics Course, Vol.- I.
-
- A. Beisser, "Concepts of Modern Physics"
 - Rajam, "Atomic Physics"
 - Greiner, "Quantum Physics"
 - Griffith, "Introduction to Electrodynamics"
 - Nuclear Physics, by K. Hyde
 - Concepts of Nuclear Physics, by Cohen
 - Particle Physics, by Griffith

Reference Books:

- Solid State Physics : Kittel
- Solid State Physics : R.L. Singhal
- Quantum Mechanics : Schiff

ELE - 205T- Engineering Mechanics

L – P

4 – 0

Unit-I

Fundamentals of Mechanics: Basic Dimensions and units of mechanics, Vector Fundamentals: Arbitrary Triangle Analysis, Vector Definition & Types, Multiplying Scalars & Vectors, General Vector Operations, Cartesian Components (2-D), Cartesian Unit Vectors, Dot Products, Cross Products , Mixed Triple Products. Laws of mechanics

Equilibrium of Particles and Rigid Bodies: Static Equilibrium - An Overview, Types of Forces, FBD - Free Body Diagram, Two Dimensional Particle Equilibrium, Three Dimensional Particle Equilibrium. Two Dimensional Static Equilibrium of rigid bodies, Three Dimensional Static Equilibrium of rigid bodies.

Force System Resultants: Moment of a Force - Scalar Formulation, Vector Formulation, Resultant Moment of a Force System, Moment of Force about a Specified Line, Moment of a Couple, Force and Couple System Resultants.

Unit-II

Introduction to Structural Mechanics: The structural model, Planar truss structures, Idealization for planar trusses, truss joint identification, sign convention and member force representation. Strategy for planar truss analysis. Statical determinacy and stability of planar trusses. Numerical truss analysis (Method of joints, Method of sections & Graphical method).

Unit-III

Properties of Surfaces: First moment of an element of area, First moment of finite area, Centroid of a finite area. Second moment of an element of area, second moment of a finite area, Parallel axis theorem for second moment of a finite area. Composite areas. Product moment of an element of area. Product moment of finite area, parallel axis theorem for product moments of finite area, composite areas. Polar moment of area, principal second moment of area, principal axes.

Unit-IV

Analysis of Stresses and Strains: Forces and Stresses, Normal stress and Normal Strain. Stress and Strain diagram, Mechanical properties, Hooke's law, Modulus of elasticity. Ultimate and Allowable Stress, Factor of safety. Deformation of members under Axial Loading. Statically Indeterminate Problems. Problems involving temperature changes. Poisson's Ratio. Multiracial Loading, Generalized Hooke's Law. Dilatation. Shearing Strain. Relation among E, V & G.

Torsion: Torsion of cylindrical bars, torsional stress, modulus of rigidity and deformation.

Unit-V

Members subjected to Flexural Loads: Reactions: Reaction forces for Planar Structures (Beams), Support conditions (real versus idealized). Determinacy and stability of planar structures (Beams). Computation of Reactions using equations of equilibrium.

Internal Forces: Internal forces for flexural members. Notation and sign convention. Statical Determinacy & Stability of Beams. Determination of Internal Forces. Relationship between Load, shear and bending Moment. Shear Force and Bending Moment Diagrams.

Books Recommended:

- Shames I.H., Engineering Mechanics, Prentice Hall, New Delhi.
- Beer, F.P. and Johnston, Vector Mechanics for Engineers, McGraw Hill – Eighth Edition.
- Beer, F.P. and Johnston, Mechanics of Materials, Tata McGraw Hill, New Delhi.
- D.S. Kumar, Engineering Mechanics, S.K. Kataria & Sons, New Delhi.

Reference Books

- Popov - Engineering Mechanics of Solids
- Merian, J.L, Kraige, L.G. , Engineering Mechanics – Static's Wiley Publishers

ELE - 206T - Ethics for Engineers

L – P

3 – 0

Unit-I

Importance of studying ethics, Will help us in correcting the inaccurate notions of right and wrong
Nature and definition of ethics, Definition, and different levels of studying ethics, Normative,
Descriptive, Meta ethics, Scope or province of ethics, Concerned with the ideal or standards to which
our conduct should confirm

Unit-II

Stages of moral development, Different stages of moral development., pre-conventional, conventional
and post-conventional, Moral and non moral actions, moral concepts good bad ,right, wrong Only
voluntarily actions and habitual actions of a rational person are objects of moral judgments.

Unit-III

Notions of right, wrong good, bad are connected with moral laws which are subservient to highest
good's, Quranic concept of man: viceregency and its ethical implications To uphold the values of Shariah
and to be obedient to will of Allah

Unit-IV

Duties of engineers towards human beings, Responsibilities of engineers towards humanity,
Islamic perspective of Human Rights and social ethics in Islam How to maintain peace in the society.
concept of class less society

Unit-V

Computer ethics, History of Computer ethics. Computer Crimes, Bio-Ethics, Emerging new applied
discipline in ethics. How present developments in Bio-technology effects our freedom and dignity
Ethics for engineers, need of computer ethics, How reductionistic approach is dangerous and make
them aware about the growing sense of computer crime such as viruses , hacking

Books Recommended:

1. Frankana Walliam .K :Ethics
2. Sinha. J.N :Manual of Ethics
3. P Showket Ali : Human Rights in Islam
4. M.Yousf Islahi :Etiquetts of Life in Islam

ELE - 207P - Computer Programming Lab

L - P

0 - 2

Lab 1 Introduction to C Programming

Lab 2 Simple programs in C

Lab 3 C Program Control

Lab 4 Making Decisions

Lab 5 Functions

Lab 6 Functions continued

Lab 7 Loops

Lab 8 Arrays and Matrices

Lab 9 Introduction to Pointers

Lab 10 Arrays and Pointers

Lab 11 Characters and Strings

Lab 12 **Project Presentation**

ELE - 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.

ELE - 209P – 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 |

B-Tech Electrical Engineering

Semester-III

Course Code	Course Title	L – P	Credit
ELE 301T	Electronic Devices and Circuits	4 – 0	4
ELE 302T	Network Analysis	4 – 0	4
ELE 303T	Electrical Engineering Materials	4 – 0	4
ELE 304T	Electromagnetic Fields and Waves	4 – 0	4
ELE 305T	Mathematics-III	4 – 0	4
ELE 306P	Electronic Devices and Circuits Lab	0 – 4	2
ELE 307P	Electrical Workshop	0 – 4	2
ELE 308P	Introduction to MATLAB	0 – 4	2
	Total Credits	20 – 12	26

ELE - 301T - Electronics Devices and Circuits

L – P

4 – 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**

ELE - 302T - Network Analysis

L – P

4 – 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.

Second and higher order differential equations (Internal & External Excitations)

Unit-III:

Laplace Transformations:

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-IV:

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-V:

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

Fourier Analysis: Fourier Transform, Fourier Series and signal spectra.

Books Recommended:

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

ELE - 303T - Electrical Engineering Materials

L – P

4 – 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.

ELE - 304T- Electromagnetic Fields and Waves

L – P

4 – 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)

ELE -305T- 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

ELE- 306P – Electronics Devices and Circuits Lab

L – P

0 – 4

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

ELE- 307P - Electrical Workshop

L – P

0 – 2

1. **Brief description of wires and cables:** Types of wires and cables, grade of wires. Size of wires, Allowable voltage drops in different electric circuits, Allowable maximum temperature-rise in wires or cables, study of gauge, diameter and cross-sectional area of wires and determination of their current-carrying capacity (as per the Indian Standards institution (I.S.I.),
2. **Wiring Accessories:** Different types of switches, sockets, fuses, Lamp holders, wall plugs, power distribution boards, bus bars, Thimbles, etc. and their use in practice exercises.
3. **Earthing.** Why an electrical installation is earthed, earth plate or electrode, Distance of Earth pit from a building, Different types of earthings, the appliances to be earthed, earth leakage trap or circuit breaker.
4. **Electric Shock :-** Electric shock, causes of electric shock, precautions to be taken while working on an electric line, treatment of electric shock exercise.
5. **Electrical Appliances:-** Electric bells, Electric Heater, classification of lamps (brief description), How to connect and use a fluorescent lamp, Lean, lamp, Industrial lamps, street lighting lamps and different kinds of fixtures.
6. **Arrangement of Distributor boards:** Main Switch and switch board, service mains, 3 phase a-c supply arrangement, Different parts of wiring system of a large buildings – Main cables, correct estimation of sizes of cables, protection of circuits, etc. Exercises.
7. **Faults in wiring system and their remedies:** Lamp does not light up, over bright or under bright lamp, excessive heating in the wiring systems, Leakage in the wiring system, defect in the fluorescent lamp circuits and corresponding remedies.

Books Recommended

1. Electric Wiring by Samuddar.

ELE -308P – 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
ELE 401T	Electric Machines-I	4 – 0	4
ELE 402T	Electrical Measurements and Instrumentation	4 – 0	4
ELE 403T	Control Systems-I	4 – 0	4
ELE 404T	Digital Electronics & Logic Design	4 – 0	4
ELE 405T	Mathematics-IV	4 – 0	4
ELE 406P	Electric Machines-I Lab.	0 – 4	2
ELE 407P	Electrical Measurements and Instrumentation Lab	0 – 4	2
ELE 408P	Control System Lab	0 – 4	2
ELE 409P	Digital Electronics & Logic Design Lab	0 – 2	1
	Total Credits	20 – 14	27

ELE - 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

ELE - 402T – Electrical Measurements and Instrumentation

L P
4 0

Unit I:

Definition of basic terms used in measurements, Classification, efforts utilized in measuring instruments, various forces in an electro-mechanical indicating instrument, errors and their types, various methods of damping, galvanometers (D' Arsonal and Ballistic) Ammeters and Voltmeters (PMMC, Induction, Electrostatic and Dynamometer type), errors in voltmeters and ammeters, extension of instrument range, ammeter shunts, voltmeter multipliers.

Unit II: Measurement of Power, Energy and Power Factor

Power measurement in three phase a.c. circuits using single phase and 3-phase watt meter, measurement of reactive power (Single phase and 3-phase), Energy measurement using induction type meter, Energy meter testing, Power factor meter.

Unit III: Measurement of Resistance:

Resistance classification, Measurement of Low resistance using potentiometer method and Kelvin double bridge, Measurement of medium resistance using ammeter-voltmeter method, substitution method, wheatstone bridge, Measurement of high resistance using loss of charge method, Meggar.

Unit IV:

Measurement of Inductance, Capacitance and Frequency using A.C bridges.

Unit V: Transducers:

Measurement of Non Electrical Quantities: Various types of transducers, measurement of displacement, speed, stress, strain.

Books Recommended:

1. Electrical Measurements and Measuring Instruments by Golding, Widdis.
2. Electrical Electronic Measurements by A.K.Sawhney.
3. Electrical Measurements by Cooper

ELE - 403T – Control Systems-I

L P
4 0

Unit-I: Introduction to 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: Continuous-Time System Response and Stability

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; The concept of stability, BIBO stability, Relation between characteristic equation roots and BIBO stability, Routh-Hurwitz stability criterion, Relative stability analysis;

Unit-III: 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-IV: 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.

Unit-V: 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.

Text Books:

1. **Nise S.** - 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.

ELE - 404T – Digital Electronics & Logic Design

L P
4 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.

ELE - 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.

ELE – 406P – Electrical Machines-I Laboratory

L P
0 4

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.

ELE – 407P – Electrical Measurement Laboratory

L P
0 4

List of Experiments

1. Power Measurement in single phase and three phase circuits using single phase and three phase wattmeters.
2. Energy Measurement using watthour meter as well as using wattmeter and stop watch.
3. To study the constructional details of an electromechanical indicating instrument with the help of demonstration type of instrument.
4. Measurement of Inductance and capacitance using Bridge techniques (Anderson's Bridge, Wheat Stone's Bridge.)
5. Measurement of Resistance by different methods (Loss of charge method, substitution Method, Kelvins Double Bridge)
6. To Study RC and LC models of a transmission line and observe the variation of voltage magnitude and phase along the line.

ELE- 408P- Control System Laboratory

L P
0 4

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

ELE – 409P – Digital Electronics & Logic Design Lab

L P
0 2

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.

B-Tech Electrical Engineering

Semester - V

Course Code	Course Title	L – P	Credit
ELE 501T	Electrical Machines-II	4 – 0	4
ELE 502T	Power Systems – I	4 – 0	4
ELE 503T	Microprocessors	4 – 0	4
ELE 504T	Communication Systems	4 – 0	4
ELE 505T	Mathematics-V	4 – 0	4
ELE 506P	Electrical Machines-II Lab	0 – 3	2
ELE 507P	Power System-I Lab	0 – 3	2
ELE 508P	Microprocessors Lab	0 – 3	2
	Total Credits	20 – 9	26

ELE - 501T –Electrical Machines-II

L P
4 0

UNIT I: Basic Concepts in A.C. Rotating Electrical Machines

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

UNIT II: Induction Machines

Three Phase Induction Motors Principle of operation of an induction motor, Construction, Types, slip, Equivalent circuit, Torque/speed characteristics, losses and efficiency, Induction motor tests, Starting, Speed control, Induction generator, Schrage Motor, Circle Diagram,

UNIT III: Single-Phase Induction Motors

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: Synchronous Generators (Alternators)

Constructional features, Types and working principle, 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, steady-state power-angle characteristics, Excitation systems,

UNIT V: Synchronous Motors

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, constant power lines, Synchronous condenser/ synchronous phase Modifier, hunting, damper windings.

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 Geroge Mc Pherson John Wiley 1990 5.
5. Electric Machinery Fundamentals Chapman Tata Mcgraw hill 2010
6. Electric machineryby Dr. P.S. Bimbhra, Khanna Publishers

ELE - 502T –Power System-I

L P
4 0

UNIT I

Introduction to Power Systems generation, transmission & distribution, Element of AC distribution. Single fed, double fed and ring main distributor.

Per Unit Representation of Power Systems, Single line diagram, impedance and reactance diagram of a system, per unit calculations.

UNIT II

Overhead line insulator types; pin, suspension, strain, shackle, guy etc. String efficiency & methods of equalizing potential drop over string of suspension insulators.

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

UNIT III

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, proximity effect, corona, interference of power lines with communication lines.

UNIT IV

Performance of lines: Models of short, medium and long transmission lines. ABCD constants, Ferranti effect, Power transfer capability of a transmission line.

UNIT V

Load Flow- 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, line flow equations and fast decoupled method

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.Cotton Hodder Arnold 3rd Revised edition
5. Power Systems by J.B. Gupta, SK Kataria and sons

ELE-503T -Microprocessors

L P

4 0

UNIT I

Evolution and introduction to microprocessors, internal architecture(ALU, Register Array, timing and Control Unit), Memory-Read only Memory(ROM), Random access memory(RAM), Input/output devices, system bus, microprocessor languages(machine language, assembly language), ASCII code.

UNIT II

8085 pin-out diagram, function of different pins, data bus, address bus, multiplexing and de-multiplexing of address/data lines, control bus, control and status signals, internal architecture (ALU, Register Array, timing and Control Unit), flags, state transition diagrams, T-states (clock cycles), machine cycles, instruction cycles, basic interfacing devices (buffers, tri-state devices, decoders, encoders, latches)

UNIT III

8085 assembly language programming, Different addressing modes, instruction set, arithmetic and logic operations, timing diagrams, basic interfacing concepts, interfacing input devices, interfacing output devices, memory mapped I/O

UNIT IV

Interrupts, Stack and Subroutines, counters and time delays, serial input/output and data communication

UNIT V

Interfacing peripheral devices, Programmable peripheral interface (8255), Programmable keyboard display interface (8279), DMA controller (8237), Multi-purpose programmable device (8155). Introduction to 8086 microprocessor and microcontrollers (Architecture and pinout diagram).

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)

ELE- 504T-Communication Systems

L P

4 0

UNIT I

Benefits of communication technology, Block diagram of a general communication system. Analog and digital communication, Modulation, Need for modulation. Signal Spectrum: fourier series analysis of periodic signals, Fourier transform. Amplitude Spectrum of signals, power spectrum of signals

UNIT II

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, Vestigial Side band A M signal (Brief ideas). Frequency division multiplexing

UNIT III

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

UNIT IV

Digital communication: Advantages, sampling theorem, quantization, quantization error, SNR due to quantization, Pulse code modulation, Time Division multiplexing. Digital modulation techniques: ASK, FSK. PSK, M-ary PSK, QAM. Modem

UNIT V

Introduction to Secure Message Communication, Active and Passive Attacks. Encryption techniques, spread spectrum systems (basic Idea) 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
6. Electronic Communication Systems(Fundamentals through advanced), W. Tomassi, Pearson Education

ELE-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-eighth 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

ELE – 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

ELE – 507P–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.

ELE-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.

B-Tech Electrical Engineering

Semester-VI

Course Code	Course Title	L – P	Credit
ELE 601T	Power Systems-II	4 – 0	4
ELE 602T	Power Electronics	4 – 0	4
ELE 603T	Digital Signal Processing	4 – 0	4
ELE 604T	Control System-II	4 – 0	4
ELE 605T	Design of Power Apparatus	4 – 0	4
ELE 606P	Power System-II Lab	0 – 3	2
ELE 607P	Power Electronics Lab	0 – 3	2
	Total Credits	20 – 6	24

ELE - 601T -Power System-II

L P
4 0

UNIT I: Economic Load Dispatch

System Constraints, Economic Dispatch neglecting losses, Optimum Load Dispatch including transmission losses, Exact transmission loss Formula, Modified coordination equations, Automatic Load Dispatch, Power Line Carrier Communication(PLCC).

UNIT II: Fault Analysis (Balanced Faults):

Faults, types of faults, symmetrical 3-phase balanced faults – calculation of fault currents, current limiting reactors.

UNIT III: Fault Analysis (Un-symmetrical Faults)

Symmetrical components, sequence impedances, sequence networks, unsymmetrical faults –single line to ground, line-to-line, double line to ground faults on unloaded alternators and on power systems,

UNIT IV: Power system stability

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, Neutral Grounding, Effect of grounding on stability.

UNIT V: Surge Performance of Transmission Lines:

Traveling waves on transmission lines, open-end line, short-circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at a T-junction, line terminated through a capacitance, line terminated through an inductance, Attenuation of traveling waves.

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

ELE - 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, SCRs, BJTs, Power MOSFETs, IGBTs, GTOs) , 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, issue of harmonics, Three phase bridge rectifiers, issue of harmonics, Effect of source inductance.

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 Three- Phase controllers (Different circuit configurations)

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.

ELE - 603T –Digital Signal Processing

L P
4 0

UNIT I: Discrete Time Signals & Systems

Sequences, & sequence operations, Discrete-time systems. Linear Time – Invariant systems, impulse response, causality, stability. Frequency-Domain Representation of Discrete-Time signals and systems, Fourier Transforms, properties, theorems.

UNIT III: Sampling of Continuous – Time Signals.

Periodic sampling, frequency- domain representation of sampling, reconstruction of signals, discrete-time processing of continuous –time signals, continuous –time processing of Discrete-time signals, changing the sampling rate.

UNIT III: Transform Analysis of Linear time Invariant Systems.

Z- Transform, Region of Convergence, properties, Inverse Z-Transform, Frequency Response of LTI systems, system functions, linear constant coefficient, difference equations FIR and IIR systems, Frequency Response.

UNIT IV: Structure of Discrete-Time Systems.

Block Diagram Representation of linear constant-coefficient Difference equations, signal flow graph representation. Basic structures for IIR systems, Transposed forms, Basic network structures for FIR systems.

UNIT V: Filter Design Techniques.

Design of Discrete-Time IIR filters from continuous – Time filters. Impulse invariance, bilinear transformation. Butterworth Chebyshev, Elliptic Approximation, low pass, high pass, band-pass and Band-stop filters, design of FIR filters by windowing. Kaiser, Hamming, Hamming windows.

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.

ELE - 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.

ELE - 605T –Design of Power Apparatus

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: Armature Winding Design:

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: Design of D.C Machines:

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

UNIT IV: Design of single-phase and three-phase Transformers

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

UNIT V: Design of Induction Motors (1-phase and 3-phase)

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

ELE – 606P–Power System-II Lab

L P
0 4

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. Application of software packages in power systems.

ELE – 607P–Power Electronics Lab

L P
0 4

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).

B-Tech Electrical Engineering

Semester-VII

Course Code	Course Title	L – P	Credit
ELE 701T	Electrical Drives	4 – 0	4
ELE 702T	Power System Protection	4 – 0	4
ELE 703T	Microcontroller & Applications	4 – 0	4
ELE 704T	Industrial Management	3 – 0	3
ELE 705T	Elective-I	4 – 0	4
ELE 706P	Electrical Drives Lab	0 – 4	2
ELE 707P	Power System Protection Lab	0 – 2	1
ELE 708P	Preliminary Project Work/ Seminar	0 – 4	2
ELE 709P	Practical Training		2
	Total Credits	19 - 10	26

Electives for 7th Semester

4. Fuzzy Logic & Neural Networks
5. High Voltage Engineering
6. Non Conventional Energy Sources

ELE - 701T – Electrical Drives

L P
4 0

UNIT I: Electric Drives

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: D. C Motor Drives:

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: Chopper control of DC Motor Drives:

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: Induction Motor Drives:

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: Special Motor Drives:

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.

ELE - 702T – Power System Protection

L P
4 0

UNIT I: PROTECTIVE RELAYING

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: PROTECTION OF GENERATORS & TRANSFORMERS:

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, BUSBARS AND TRANSMISSION LINES:

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: CIRCUIT BREAKERS:

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: FUSES:

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).

ELE - 703T – Microcontroller & its Applications

L P
4 0

Microcontrollers and their Applications : Brief Review of 8255A PPI, 8259 PIC and 8251 USART peripheral chips.

Historical background of micro-controllers, Introduction to Intel 8 bit & 16 bit Micro-controllers, 8031/8051 – Architectural details, Bus timing, Memory organization, Memory Map expansion, Fetch / Execute sequences, External Memory Access, Addressing Modes, Hardware description of 8031/51, Instruction formats, Instruction sets, interrupt structure & interrupt priorities, Port structures & Operation, linear counter Functions, different Modes of Operation and Programming examples, Interfacing, Adding external devices to the bus, Some practical examples of interfacing (Example: Converter and Inverter control).

Recommended Books:

1. The 8051 Micro-controller: Architecture, Programming and Applications by Kenneth J. Ayal
2. Programming & Customizing the 8051 Micro-controller by M. Predko
3. Intel Manual
4. Microprocessors and Programmed Logic by K.L. Short.

ELE - 704T – Industrial Management & Economics of Marketing

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 MarlUelG. Valesquez, (1998). *Business Ethics*, Pearson Education

3. Drucker P Panbooks (2000). *Managing in Turbulent times* London:

4 Boatright 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,

ELE - 705T – Elective-I

L P
4 0

Syllabi Given under Electives List

ELE – 706P – Electrical Drives Lab

L P
0 4

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.

ELE – 707P – Power System Protection Lab

L P
0 2

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.

ELE 708P Preliminary Project Work/ Seminar

L P
0 4

ELE 709P Practical Training

2 Credits

Syllabus of Electives for 7th Semester

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.
2. Kosco B, Neural Networks and Fuzzy Systems: A Dynamic Approach to Machine Intelligence, Prentice Hall of India, New Delhi.
3. Klir G.J and Folger T.A, Fuzzy sets, Uncertainty and Information, Prentice Hall of India, New Delhi.
4. Simon Haykin, Neural Networks, ISA, Research Triangle Park.

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.
2. Wadhwa.C.L, “High Voltage Engineering”, Wiley Eastern Limited.
3. Kuffel.E and Abdullah. M, “High Voltage Engineering”, Pergamon Press.
4. Dieter Kind, “An Introduction to High Voltage Experimental Technique”, Wiley Eastern Limited.
5. Ravindra Arora, Wolfgang Mosh, “High Voltage and Electrical Insulation Engineering”, Wiley-VCH Publishers.

NON-CONVENTIONAL ENERGY SOURCES

UNIT I

Review of conventional & Non-conventional Energy resources, Energy problem, Energy & Environment, Need for renewable, Relevant energy conversion systems & Technologies, Electricity generation, Rural Energy.

UNIT II

Wind & Solar Energy, Principles of Power Generation from wind, site selection, wind speed & power duration curves, wind power system components, Wind-Diesel Hybrid systems & recent developments. Solar radiation, solar collectors – flat plate & concentrating collectors, Solar water heaters & solar thermal power plants. Miscellaneous Applications

UNIT III

Electric Power Generation from Tidal, OTEC & Geothermal energy. Simple power plant based on Tidal / OTEC / Geothermal.

Direct Energy Conversion techniques, Why Direct Energy Conversion, Solar cell, principle and operation. Solar module & array, solar photovoltaic power system / solar wind Diesel system – operation & design. MHD & Thermo-Electric power generation.

UNIT IV

Energy conservation, Energy conservation in Transport sector, rural energy, urban energy, Industrial energy, power generation & distribution, Energy efficient buildings, Energy audit, Typical case studies.

UNIT V

Future Energy Sources, Nuclear Fusion Energy – Tokamak reactor, Hydrogen Energy An introduction to power generation, advantages and limitations. Exploring new energy sources. Economic evaluation of energy systems.

Books Recommended:

1. Non-Conventional Energy Resources, R.K Singal – Dhanpat Rai publication
2. Energy Technology – S. Rao, B.B Parlekar – Khanna Publications
3. Wind & Solar Power System – CRC Press
4. Principle of Energy Conversion- Culp-Mc Graw Hill Publication.

8th Semester

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

Elective Subjects for 8th Semester

1. Selected Topics in Advanced Control
2. Optimal Control
3. Power Systems Transients
4. EHV AC & DC Transmission
5. Advanced Electrical Drives
6. Flexible AC Transmission Systems
7. Power Station Practice

ELE – 801T – Advanced Power Electronics

L P
4 0

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.
- 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

ELE-802T OPTIMIZATION TECHNIQUES

L P
4 0

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.
2. Kalyanmoy Deb, “Multi objective optimization using Evolutionary algorithms”, John Wiley.
3. Taha, Operations Research, TMH.

ELE-803TE Elective-I

L P
4 0

The syllabus of the course is given in List of Electives.

ELE-804TE Elective-I

L P
4 0

The syllabus of the course is given in List of Electives.

ELE-805P Project

L P
0 18

Elective Subjects for 8th Semester

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.

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
2. R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited.
3. M.S. Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hil.

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 inline 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 Transimission Engineering”, New Age International(P).
2. Padiyar. K.R “HVDC Power Transmission Systems”, New Age International(P) Limited.
3. Chakrabarti AM. L. Soni, P.V.Gupta, U.S.Bhatnagar, “Power System Engineering”, DhanpatRai & Co.
4. Sunil S.Rao, “Switchgear Protection and Power Systems”, Khanna Publishers.

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 Cyclo converter-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.

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 Laszl Gyugyi, “Understanding FACTS – Concept &technology of flexible AC transmission systems”, Standard publishers & distributors, IEEE press.
2. Padiyar.K.R,” FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Limited, Publishers, New Delhi.

POWER STATION PRACTICE

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).