B.Sc. (H) ELECTRONICS

THREE-YEAR FULL-TIME PROGRAMME
(Six-Semester Course)

COURSE CONTENTS

(Effective from the Academic Year 2010-2011)

UNIVERSITY OF DELHI
DELHI – 110 007

Syllabus Structure for Semester I-VI [B. Sc. (H) Electronics]

Paper No.	**Semester-I**	**L-T**	**Paper No.**	**Semester-II**	**L-T**
ELHT101	Applied Quantum Mechanics	4-1	ELHT201	Signals and Systems	4-1
ELHT102	Engineering Materials	4-1	ELHT202	Semiconductor Devices	4-1
ELHT103	Network Analysis	4-1	CSAT 201	Computational Skills ***(Compulsory)***	4-1
ENAT 101	Technical Writing & Communication in English ***(Compulsory)***	4-1	MAHT 204	Mathematics-I ***(Allied Paper)***	4-1
ELHP105	Electronics Practical-I *Based on ELHT101 and ELHT102*	8 Hours per week	ELHP205	Electronics Practical-III *Based on ELHT201 and CS*	8 Hours per week
ELHP106	Electronics Practical-II *Based on ELHT103*	8 Hours per week	ELHP206	Electronics Practical-IV *Based on ELHT202*	8 Hours per week

Paper No.	**Semester-III**	**L-T**	**Paper No.**	**Semester-IV**	**L-T**
ELHT301	Digital Electronics	4-1	ELHT401	Numerical Techniques	4-1
ELHT302	Analog Electronics-I	4-1	ELHT402	Analog Electronics-II	4-1
MAHT305	Mathematics-II ***(Allied Paper)***	4-1	ELHT403	Electromagnetics	4-1
CS-1	Fundamental of Programming Languages ***(Allied Paper)***	4-1	CS-2	Data Structures ***(Allied Paper)***	4-1
ELHP305	Electronics Practical-V *Based on ELHT301and CS-1*	8 Hours per week	ELHP405	Electronics Practical-VII *Based on ELHT401 and CS-2*	8 Hours per week
ELHP306	Electronics Practical-VI *Based on ELHT302*	8 Hours per week	ELHP406	Electronics Practical-VIII *Based on ELHT402*	8 Hours per week

Paper No.	**Semester-V**	**L-T**	**Paper No.**	**Semester-VI**	**L-T**
ELHT501	Microprocessors and Microcontrollers	4-1	ELHT601	Electrical Machines	4-1
ELHT502	Analog Communication	4-1	ELHT602	Digital Communication	4-1
ELHT503	Electronic Instrumentation	4-1	ELHT603	Optics and Optical Electronics	4-1
ELHT504	Wave Propagation and Antenna	4-1	ELHT604	Engineering Mathematics	4-1
ELHP505	Electronics Practical-IX *Based on ELHT501*	8 Hours per week	ELHP605	Electronics Practical-XI *Based on ELHT601 and ELHT602*	8 Hours per week
ELHP506	Electronics Practical-X *Based on ELHT502 and ELHT503*	8 Hours per week	ELHP606	Electronics Practical-XII *Based on ELHT603*	8 Hours per week

L – Lecture T – Tutorial P - Practical

Courses with 4L and 1T : 4 Credits
Courses with 8 hrs. Practicals : 4 Credits (2hrs lab equivalent to 1 Credit)

ELHT-101: Applied Quantum Mechanics

THEORY Marks: 100

Unit 1

Wave Particle Duality: Inadequacies of Classical physics. Compton's effect, Wave-particle duality, de Broglie waves. Davisson and Germer's experiment. Group and Phase velocities, Wave Packets. Heisenberg's uncertainty principle: Derivation from wave-packets, γ-ray microscope experiment, Electron two-slit experiment.

Unit 2

Quantum Mechanics: Basic postulates and formalism of quantum mechanics: probabilistic interpretation of waves, conditions for physical acceptability of wave functions. Schrodinger wave equation for a free particle and in a force field (1 dimension), Boundary and continuity conditions. Operators in Quantum Mechanics, Conservation of probability, Time-dependent form, Linearity and superposition, Operators, Time-independent one dimensional Schrödinger wave equation, Stationary states, Eigen-values and eigen-functions.

Unit 3

Applications of Schrödinger wave equation: Particle in a one-dimensional box, Extension to a three dimensional box, Potential barrier problems, phenomenon of tunneling. The Hydrogen Atom (without detailed solution of differential equations).

Unit 4

Atoms in electric and magnetic fields: Electron spin, Spin and Orbital angular momentum, Space quantization and Larmor's theorem, Stern-Gerlach experiment, Magnetic moment of the atom, Gyromagnetic ratio and Bohr Magneton. Atoms in external magnetic fields:- Zeeman effect (Normal and Anomalous).
Many electron atoms: Pauli's exclusion principle. Symmetric and Antisymmetric wave functions, Atomic Shell Model. Periodic table. Spin orbit coupling. Fine structure. Total angular momentum. Vector Model. L-S and J-J couplings (for 2 valence electrons only). Term symbols. Spectra of hydrogen and alkali atoms (Na). Spectral terms. Doublet fine structure of alkali spectra. Empirical evidence of multiplets. Selection rules.

Suggested Books:

1. A. Beiser, Concepts of Modern Physics , McGraw-Hill Book Company (1987)
2. A. Ghatak & S. Lokanathan, Quantum Mechanics: Theory and Applications, Macmillan India (2004)
3. G. Herzberg, Atomic Spectra and Atomic Structure, Dover Publications (1944)
4. E. Merzbacher, Quantum Mechanics, John Wiley & Sons (1997)
5. H. E. White, Introduction to Atomic Physics, McGraw Hill (1985)

ELHT-102: Engineering Materials

THEORY Marks: 100

Unit 1

Crystal Structure and Bonding: Crystalline and Non-crystalline solids, Crystal Lattice, Unit Cell, Miller Indices and Miller Planes, Principle of X-ray diffraction. Imperfections and defects of the crystal lattice, Point defects, Colour centers, Line defects, Plane defects.
Thermal Properties: Brief introduction to laws of thermodynamics, concept of Entropy, concept of Phonons**,** Heat capacity, Debye's Law, Lattice specific heat, Electronic Specific heat, Specific heat capacity for Si and GaAs, Thermal Conductivity, Thermoelectricity: Seebeck Effect, Thomson Effect, Peltier Effect.

Unit 2

Mechanical Properties: Elastic and Plastic Deformations, Hooke's Law, Elastic Moduli, Brittle and Ductile Materials, Tensile Strength, Theoretical and Critical Shear Stress of crystals. Strengthening mechanisms, hardness, creep, fatigue, fracture.
Electric Properties: Conductivity of metals, Ohm's Law, relaxation time, collision time and mean free path, electron scattering and resistivity of metals, heat developed in current carrying conductor, Superconductivity. Conduction in Semiconductors: Classifying materials as semiconductors, conduction in intrinsic and extrinsic semiconductors, Hall effect.

Unit 3

Magnetic Properties: Classification of Magnetic Materials, Origin of Magnetic moment, Origin of dia, para, ferro and antiferro magnetism and their comparison, Ferrimagnetic materials, Saturation Magnetisation and Curie temperature, Magnetic domains, Concepts of Giant Magnetic Resistance (GMR), Magnetic recording.

Unit 4

Dielectric Properties: Polarization and Dielectric constant, the three vectors: D, E and P, Static Dielectric Constant of Solids, Claussius –Mossotti relation, Polarization mechanisms and total polarization, Ferroelectric Materials, Spontaneous Polarization, Curie-Weiss Law, Classification. Piezoelectricity. Dielectrics in Alternating Fields, Temperature and Frequency dependence of dielectric constants.
Introduction to Modern Materials : Ceramics, Polymers and Composites. Nanomaterials (role of size in properties and applications).

Suggested Books:

1. A. J. Dekker, Electrical Engineering Materials, Prentice Hall India (2009)
2. A. J. Dekker, Solid State Physics, Macmilan (2003)
3. C. Kittel, Introduction to Solid State Physics, Wiley (1996)
4. W. E. Callister, Material Science and Engineering: An Introduction, Wiley India (2006)
5. M. S. Vijaya and G Rangarajan, Material Science, Tata McGraw Hill (2003)

ELHT-103: Network Analysis

THEORY Marks: 100

Unit 1

Basic Circuit Concepts: Voltage and current sources, Resistance, Capacitance, Inductance, Mutual Inductance, Series and Parallel elements, Duality, voltage division and current division.
Circuit Analysis: Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node analysis, Mesh analysis, Star-Delta conversion.
Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem, Maximum power transfer theorem.

Unit 2

DC Transient Analysis : Initially charged RC circuit, RL circuit with initial current, time constant, RL and RC circuits with sources, DC response of series RLC circuits (using differential equations).

Unit 3

AC circuit analysis: Sinusoidal voltage and current, Definition of instantaneous, peak, peak to peak, root mean square and average values. Voltage-current relationship in resistor, inductor and capacitor. Phasor, complex impedance, power in AC circuits: instantaneous power, average power, reactive power, power factor. Sinusoidal circuit analysis for RL, RC and RLC circuits. Mesh analysis, node analysis and network theorems for AC circuits.
Resonance in series and parallel RLC circuits, frequency response of series and parallel RLC circuits, Quality (Q) factor and bandwidth. Passive filters: low pass, high pass, band pass and band stop.

Unit 4

Two Port Networks: Impedance (Z) parameters, Admittance (Y) parameters, Transmission (ABCD) parameters, Hybrid (h) parameters.

Suggested Books:

1. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill (2005)
2. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
3. M. Nahvi and J. Edminister, Electric circuits, Schaum's outline series, Tata McGraw Hill (2005)
4. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)
5. C. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2009)
6. John. D. Ryder, Networks, Lines and Fields, Prentice Hall of India (2002)

ENAT-101: Technical Writing and Communication in English

THEORY Marks: 100

Unit 1

Communication: Language and communication, differences between speech and writing, distinct features of speech, distinct features of writing.

Unit 2

Writing Skills; Selection of topic, thesis statement, developing the thesis; introductory, developmental, transitional and concluding paragraphs, linguistic unity, coherence and cohesion, descriptive, narrative, expository and argumentative writing.

Unit 3

Technical Writing: Scientific and technical subjects; formal and informal writings; formal writings/reports, handbooks, manuals, letters, memorandum, notices, agenda, minutes; common errors to be avoided.

Suggested Books:

1. M. Frank. Writing as thinking: A guided process approach, Englewood Cliffs, Prentice Hall Reagents.
2. L. Hamp-Lyons and B. Heasely: Study Writing; A course in written English. For academic and professional purposes, Cambridge Univ. Press.
3. R. Quirk, S. Greenbaum, G. Leech and J. Svartik: A comprehensive grammar of the English language, Longman, London.
4. Daniel G. Riordan & Steven A. Panley: "Technical Report Writing Today" - Biztaantra.

Additional Reference Books

5. Daniel G. Riordan, Steven E. Pauley, Biztantra: Technical Report Writing Today, 8th Edition (2004).
6. Contemporary Business Communication, Scot Ober, Biztantra, 5th Edition (2004).

ELHP-105: Electronics Practical-I
Based on Paper ELHT-101 and ELHT-102

PRACTICALS Marks: 50

1. To determine Young's modulus of a wire by optical lever method.
2. To determine the modulus of rigidity of a wire by Maxwell's needle.
3. To determine the elastic constants of a wire by Searle's method.
4. To measure the resistivity of a Ge crystal with temperature by four –probe method from room temperature to 200 ^{0}C).
5. To determine the Hall coefficient and the Hall angle of a semiconductor.
6. To measure the magnetic susceptibility of solids by Gouys' method.
7. To measure the magnetic susceptibility of paramagnetic liquid by Quincke's method.
8. To draw the B-H curve of iron by using a solenoid and to determine the energy loss due to Hysteresis.
9. Measurement of field strength B and its verification in a solenoid (determination of dB/Dx).
10. To determine the value of Boltzmann Constant by studying forward characteristics of diode.
11. To determine the value of Planck's constant by using a Photoelectric Cell.
12. To determine the value of Planck's constant by using LEDs of at least 4 different wavelengths.
13. To determine e/m of electron by Bar Magnet or by Magnetic Focusing.
14. To determine the wavelengths of Hydrogen spectrum and determine the value of Rydberg's constant.
15. To determine lines in the rotational spectrum of Iodine vapor.

ELHP-106: Electronics Practical-II
Based on Paper ELHT-103

PRACTICALS Marks: 50

1. Introduction to Basic Electronic Components (resistor, capacitor, inductor, diode and transistors).
2. Introduction to Test and Measurement Instruments (power supply, signal generator, multimeter, CRO, DSO)
3. Verify the Thevenin, Norton and Superposition Theorem.
4. Verify the Maximum Power Transfer Theorem.
5. RC Circuits: Time constant, differentiator, integrator.
6. Design a Low Pass RC Filter and study its frequency response.
7. Design a High Pass RC Filter and study its frequency response.
8. To study the generation of Lissajous figures.
9. To Measure the Z-parameters of a two-port network.
10. To study the frequency response of a Series LCR circuit and determine its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.
11. To study the frequency response of a Parallel LCR circuit and determine its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.

SOFTWARE BASED SIMULATIONS

12. Verify the Thevenin, Norton and Superposition Theorem
13. Verify the Maximum Power Transfer Theorem
14. RC Circuits: Time constant, differentiator, integrator.
15. Design a Low Pass RC Filter and study its frequency response.
16. Design a High Pass RC Filter and study its frequency response.
17. To study the generation of Lissajous figures.
18. To Measure the Z-parameters of a two-port network.
19. To study the frequency response of a Series LCR circuit and determine its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.
20. To study the frequency response of a Parallel LCR circuit and determine its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.

ELHT-201: Signals and Systems

THEORY Marks: 100

UNIT 1

Signals and Systems: Continuous and discrete time signals, Transformation of the independent variable, Exponential and sinusoidal signals, Unit impulse and unit step functions, Continuous-Time and Discrete-Time Systems, Basic System Properties.

Unit 2

Linear Time-Invariant Systems (LTI): Discrete time LTI systems, the Convolution Sum, Continuous time LTI systems, the Convolution integral. Properties of LTI systems, Commutative, Distributive, Associative, LTI systems with and without memory, Invertibility, Causality, Stability, Unit Step response. Differential and Difference equation formulation, Block diagram representation of first order systems.

Unit 3

Fourier Series Representation of Periodic Signals: Continuous-Time periodic signals, Convergence of the Fourier series, Properties of continuous-Time Fourier series, Discrete-Time periodic signals, Properties of Discrete-Time Fourier series. Frequency-Selective filters, Simple RC highpass and lowpass filters, Discrete-Time filters, Recursive, Non-recursive filter.

Fourier Transform: Aperiodic signals, Periodic signals, Properties of Continuous-time Fourier transform, Convolution and Multiplication Properties, Properties of Fourier transform and basic Fourier transform Pairs.

Unit 4

Laplace Transform: Laplace Transform, Inverse Laplace Transform, Properties of the Laplace Transform, Laplace Transform Pairs, Solving Differential Equations with Intial conditions, Laplace Transform Methods in Circuit Analysis, Step response of RL, RC and RLC circuits, Impulse response of series RC, Sinusoidal response of RL circuit.

Suggested Books:

1. A. V. Oppenheim, A. S. Wilsky and S. H. Nawab, Signals and Systems, Pearson Education (2007)
2. S. Haykin and B. V. Veen, Signal and Systems, John Wiley & Sons (2004)
3. H. P. Hsu, Signals and Systems, Tata McGraw Hill (2007)
4. M. Roberts, Fundamentals of Signals and Systems,Tata McGraw Hill (2007)
5. S. T. Karris, Signal and Systems: with MATLAB Computing and Simulink Modelling, Orchard Publications (2008)
6. W. Y. Young, Signals and Systems with MATLAB, Springer (2009)

ELHT-202: Semiconductor Devices

THEORY Marks: 100

Unit 1

Semiconductor Basics: Energy band in solids (metal, semiconductor and insulators), concept of effective mass, density of states, carrier concentration at normal equilibrium in intrinsic semiconductors, derivation of Fermi level for intrinsic semiconductors, donors, acceptors, majority carriers (electrons and holes), dependence of Fermi level on temperature and doping concentration.
Diode: p-n junction diode, formation of depletion layer, space charge at a junction. Derivation of electrostatic potential difference at thermal equilibrium, depletion width and depletion capacitance of abrupt p-n junction. Diode equations and the I-V characteristic. Zener and Avalanche mechanism, Zener diode.

Unit 2

Metal Semiconductor Junctions: Ohmic & Rectifying Contacts
Bipolar Junction Transistors (BJT): PNP and NPN transistors, basic transistor action, energy band diagram of transistor in thermal equilibrium, Early effect, input and output characteristics of CB, CE and CC configurations.
Uni-junction Transistor (UJT): Construction, working and I-V characteristics of UJT.
Thyristor Devices: Basic construction and Characteristics of Thyristor, Semiconductor Controlled Device (SCR), Characteristics and two transistor model of SCR.

Unit 3

Field Effect Transistors (FET): Construction of JFET, idea of channel formation, pinch-off voltage, Transfer and output characteristics.
MOSFET: MOS Diode, Basic Construction of MOSFET and working, I-V characteristics, enhancement and depletion modes. Complimentary MOS (CMOS).

Unit 4

Semiconductor Fabrication Technology: Introduction to semiconductor technology. Basic fabrication steps:Wafer, epitaxial growth, oxidation, photolithography, etching), diffusion, ion implantation, film deposition and metallisation. Moore's Law, Medium Scale Integration (MSI), Large Scale Integration (LSI), Very Large Scale Integration (VLSI), Ultra Large Scale Integration (ULSI), Giant Scale Integration (GSI).

Suggested Books:

1. S. M. Sze, Semiconductor Devices: Physics and Technology, John Wiley & Sons (2002)
2. Ben Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)
3. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)
4. Kanaan Kano, Semiconductor Devices, Pearson Education (2004)
5. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education (2006)
6. Dennis Le Croissette, Transistors, Pearson Education (1989)

CSAT-201: Computational Skills

THEORY Marks: 100

Computer Fundamentals: Introduction to Computers - Characteristics of Computers, Uses of computers, Types and generations of Computers**.**

Basic Computer Organization - Units of a computer, CPU, ALU, memory hierarchy, registers, I/O devices User Interface with the Operating System, System Tools.

Data Representation: Binary representation of integers and real numbers, 1's Complement, 2's Complement, Addition and subtraction of binary numbers, BCD, ASCII, Unicode.

Networks terminology : Types of networks, router, switch, server-client architecture.

Multimedia: Introduction, Characteristics, Elements, Applications.

Problem Solving: Notion of algorithms, stepwise methodology of developing an algorithm, developing macros in spreadsheet.

General Awareness (4): IT Act, System Security (virus/firewall etc.) I-Tax, Reservations, Banking.

Suggested Books:

1. V. Rajaraman, Fundamentals of Computers, Prentice Hall of India , Forth edition.
2. Anita Goel, Fundamentals of Computers, Pearson-Education (2010)

Note: Use of Open Office/Star Office is recommended as the s/w is freely downloadable. Open Office available at: http://www.openoffice.org Star Office available at: http://www.sun.com/software/staroffice/

MAHT-204: Mathematics-I

THEORY Marks: 100

Unit 1

Sequences and series: Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a sequence, Infinite series, Necessary condition for Convergence, Standard Infinite Series: Geometric Series and Harmonic series, Tests for Convergence and Divergence, Comparison Test: Only for Series with Positive Terms, Cauchy's Integral Test, D'Alembert's Ratio Test, Cauchy's nth Root Test, Raabe's Test (Higher Ratio Test), Logarithmic Test, De Morgan's and Bertrand's Test, Alternating Series Leibnitz's Theorem, Absolute Convergence and Conditional Convergence, Power Series .
Mean Value Theorems: Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem, Generalized Mean Value Theorem.

Unit 2

Partial Differentiation: Functions of Several Variables: Limit and continuity, Partial Differentiation, Variable Treated as Constant, Total Derivative, Partial Differentiation of Composite Functions: Change of Variables, Differentiation of an Implicit Function, Euler's Theorem, Jacobian, Functional Dependence.
Maxima and Minima: Taylor's Theorem for Functions of Two Variables, Maxima and Minima of Functions of Two Variables: with and without Constraints, Lagrange's Method of Undetermined Multipliers.
Curve Tracing: Curves in Cartesian Form, Polar Curves, Parametric Curves.

Unit 3

Application of Integration: Length of Plane Curve: Rectification, Volume of solids of Revolution, Area of the Surface of a Solid of Revolution.
Multiple Integrals: Introduction, Double Integral, Evaluation of a double Integral, Application of double Integral, Change of Order of Integration: Double Integral, General Change of Variable in double Integral, Change Of Variable: Cartesian to Polar Coordinates, Triple Integrals, General Change of Variable in Triple Integral.

Unit 4

Vector Differential Calculus: Scalar and Vector, Vector Differentiation, Directional Derivative, Gradient of a Scalar Function and Conservative Field, Divergence, Curl, Related Properties of Gradient, Divergence and Curl of Sums, Second-Order Differential Operator, Curvilinear Coordinates: Cylindrical and Spherical Coordinates.
Vector Integral Calculus: Vector Integration: Integration of a Vector Function of a Scalar argument, Line Integrals: Work Done, Potential, Conservative field and Area, Surface Integrals: Surface area and Flux, Volume integrals, Green's Theorem in a Plane: Transformation between Line integral and Double integral Area in Cartesian and Polar Coordinates, Stokes's Theorem, Gauss Divergence Theorem.

Suggested Books:

1. E. Kreyszig, Advanced Engineering Mathematics, Wiley India (2008)
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Limited (2007)
3. R. K. Jain, and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007)

C .R. Wylie and L. C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill (2004)

ELHP-205: Electronics Practical-III
Based on Paper ELHT-201 AND CSAT-201

PRACTICALS Marks: 50

Document Preparation: Creating Documents, Formatting text, use of appropriate fonts, styles, page layouts, tables and pictures, Creating and Printing Merged Documents, Editing and Proofing Tools: Checking and Correcting Spellings

Spreadsheet Handling: Creating spreadsheet, use of labels, cell formatting, date and time, mathematical, statistical and logical functions, graphs

Presentation Software**:** Creating Presentation, Designing Templates, adding multimedia, Controlling slide show, Action Buttons, printing presentation. Exercises based on Word Processing, Presentation software, Spreadsheets (including macros)

Note: Use of Open Office/Star Office is recommended as the software is freely downloadable.
Open Office available at: http://www.openoffice.org
Star Office available at: http://www.sun.com/software/staroffice/

MATLAB BASED EXPERIMENTS – BASED ON ELT 201

Learning MATLAB
Explorations of Signals and Systems using MATLAB

1. Generation of Signals: continuous time and discrete time

2. Convolution of Signals, Solution of Difference equations.

3. Fourier series representation of continuous time signals.

4. Fourier transform of continuous time signals.

5. Discrete time Fourier analysis.

6. Introduction to SIMULINK and calculation of output of systems represented by block diagrams.

7. Sampling and reconstruction of continuous time signals.

ELHP-206: Electronics Practical-IV
Based on Paper-ELHT-202

PRACTICALS Marks: 50

1. To study the I-V Characteristics of Diode – Ordinary and Zener.
2. To study the I-V Characteristics of the Common Emitter configuration of BJT and obtain the H-parameters.
3. To study the I-V Characteristics of the Common Base configuration of BJT and obtain the H-parameters.
4. To study the I-V Characteristics of the Common Collector configuration of BJT and obtain the H-parameters.
5. To study the I-V Characteristics of the UJT.
6. To study the I-V Characteristics of the SCR.
7. To study the I-V Characteristics of the Common Source FET configuration.
8. To study the I-V Characteristics of the Common Gate FET configuration.
9. To study the I-V Characteristics of the Common Drain FET configuration.

SOFTWARE BASED SIMULATIONS

10. To study the I-V Characteristics of Diode – Ordinary and Zener
11. To study the I-V Characteristics of the Common Emitter configuration of BJT
12. To study the I-V Characteristics of the Common Base configuration of BJT
13. To study the I-V Characteristics of the Common Collector configuration of BJT
14. To study the I-V Characteristics of the UJT
15. To study the I-V Characteristics of the SCR
16. To study the I-V Characteristics of the Common Source FET configuration
17. To study the I-V Characteristics of the Common Gate FET configuration
18. To study the I-V Characteristics of the Common Drain FET configuration

ELHT-301: Digital Electronics

THEORY Marks: 100

Unit 1

Number System and Codes: Decimal, Binary, Hexadecimal, Octal, BCD, conversion of one code to another, Complements (one's and two's), Signed and Unsigned numbers, Addition and Subtraction, Multiplication Gray and Hamming Codes.
Logic Gates and Boolean Algebra: Truth Tables, OR, AND, NOT, XOR, XNOR, Universal (NOR and NAND) Gates, Boolean Theorems, DeMorgan's Theorems, Principle of duality.
Digital Logic families: Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Current and Voltage parameters, RTL, DTL, TTL, ECL, HTL, MOS, CMOS.

Unit 2

Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS), Karnaugh map minimization, Quine McCluskey minimization. Multiplexers (2:1, 4:1) and Demultiplexers (1:2, 4:1), Implementing logic functions with multiplexer, Adder (half and full) and subtractor, Encoder (8 to 3) and Decoder (3 to 8).

Unit 3

Sequential logic design: Latch, Flip flop (FF), S-R FF, J-K FF, T and D type FFs, Clocked FFs, Registers, Counters (ripple, synchronous and asynchronous, ring, modulo-N), State Table, State Diagrams and Sequential Machines.

Unit 4

A/D and D/A Converters: Successive Approximation ADC, R/2R Ladder DAC.
Memories: General Memory Operation, ROM, RAM (Static and Dynamic), PROM, EPROM, EEPROM, EAPROM.

Suggested Books:

1. R.L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill (1994)
2. Donald P. Leach, Albert Paul Malvino, Digital Principles and Applications, Tata McGraw Hill (1995)
3. M. Morris Mano, Michael D. Ciletti, Digital Design, Pearson Education Asia, (2007)
4. Thomas L. Floyd , Digital Fundamentals, Pearson Education Asia (1994)
5. S.P. Bali , Solved Problems in Digital Electronics, Sigma Series, Tata McGraw-Hill, (2005)
6. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India (2000)
7. R.P. Jain , Modern Digital Electronics, Tata McGraw-Hill (2003)

ELHT-302: Analog Electronics-I

THEORY Marks: 100

Unit 1

Diode Circuits: Ideal diode, piecewise linear equivalent circuit, dc load line analysis, Quiescent (Q) point. Positive, negative and biased clipper circuits, clamping circuits. Half wave rectifier, center tapped and bridge fullwave rectifiers, calculation of efficiency and ripple factor.
DC power supply: Block diagram of a power supply, qualitative description of shunt capacitor filter, Zener diode as voltage regulator, temperature coefficient of Zener diode.

Unit 2

The BJT: Transistor current components and amplification. Transistor configurations: Common Base (CB), Common Emitter (CE) and Common Collector (CC) configuration, I-V characteristics and hybrid parameters, regions of operation, dc load line, Q point.
CE amplifier: Self bias arrangement of CE, dc and ac load line analysis. Hybrid equivalent of CE, Quantitative study of the frequency response of CE amplifier, effect on gain and bandwidth for cascaded CE amplifier (RC coupled).
Power Amplifiers: Heat sink, Classification of power amplifiers: A, B, C and AB, analysis of Class B push pull amplifiers (efficiency, power dissipation).
Single tuned amplifiers.

Unit 3

Feedback Amplifiers: Concept of feedback, negative and positive feedback, Negative feedback: advantages and disadvantages of negative feedback, voltage (series and shunt), current (series and shunt) feedback amplifiers, derivation of gain, input and output impedances for feedback amplifiers. Positive feedback: Barkhausen criteria for oscillations, Study of phase shift oscillator and Colpitts oscillator . Colpitts Crystal oscillator.

Unit 4

The MOSFET: The three configurations: Common Gate (CG), Common Source (CS) and Common Drain (CD), I-V characteristics, regions of operation, small signal equivalent circuit, dc load line, Q point.
CS amplifier: CS amplifier circuit analysis, Qualitative study of frequency response of CS amplifier.

Suggested Books:

1. R. L. Boylestad, L. Nashelsky, K. L. Kishore, Electronic Devices and Circuit Theory, Pearson Education (2006)
2. D. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGraw Hill (2002)
3. J. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill (2010)
4. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill (2002)
5. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
6. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)

MAHT-305: Mathematics-II

THEORY Marks: 100

Unit 1

Vector Space and Linear Transformation: Vector spaces, subspaces, Bases and Dimensions, Linear Transformations, Linear operator equations.
Matrices: Introduction to Matrices, System of Linear Algebraic Equations, Gaussian Elimination Method, Gauss-Seidel Method, LU decomposition, Solution of Linear System of LU decomposition, LU decomposition from Gaussian Elimination, LU decomposition by Gaussian Elimination, Solution to Tridiagonal Systems, Crout Reduction for Tridiagonal Linear Systems.

Unit 2

Eigen Values and Eigen Vectors: Linear Transformation, Eigen Values and Eigen Vectors, Properties of Eigen Values and Eigen Vectors, Cayley-Hamilton Theorem, Diagonalization. Powers of a Matrix.
Real and Complex Matrices: Real Matrices: Symmetric , Skew Symmetric , Orthogonal Quadratic Form, Canonical Form: or sum of the squares form, Transformation (reduction) of Quadratic Form to Canonical Form, Complex Matrices: Hermitian, Skew Hermitian, Unitary Matrices, Sylvester's Law of Inertia.

Unit 3

Complex Functions: Complex Function, Continuity, Differentiability, Analyticity, Cauchy-Riemann (C-R) Equations: In Cartesian Coordinates, Harmonic and Conjugate Harmonic Functions, Cauchy-Riemann Equations.
Elementary Complex Functions: Exponential Function, Trigonometric Functions, Hyperbolic Functions.
Complex Integration: Line Integral in Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivative of Analytic Functions.
Complex Power Series: Sequences: Series and Power Series, Taylor's Series (Theorem), Laurent Series, Zeroes and Poles.
Theory of Residues: Residue, Residue Theorem, Evaluation of Real Integrals.

Unit 4

Ordinary Differential Equations (First Order and First Degree): Basic Definitions, First Order first Degree Differential Equations, Variables Separable or Separable Equation, Homogeneous Equation-Reduction to Separable Form, Non homogeneous equation: Reducible to Homogeneous Form, Exact Differential Equations, Reduction of Non-exact Differential Equations: using Integration factors, Linear Differential Equation: First Order, Bernoulli Equation, Formation of Differential Equation by Elimination of Arbitrary Constants, Geometrical Applications, Orthogonal Trajectories of Curves.

Suggested Books:

1. E. Kreyszig, Advanced Engineering Mathematics, Wiley India (2008)
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Limited (2007)
3. R. K. Jain, and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007)
4. C. R. Wylie and L.C. Barrett, Advanced Engineering Mathematics, Tata McGraw Hill (2004)

CS-1: Fundamentals of Programming Languages

THEORY Marks: 100

Programming using C/ C++: Basic data types; constants and variables, arithmetic and logical expressions; input-output methods; control structures; procedural abstractions; strings and arrays; command line arguments; basic file handling; error handling

Introduction to the object-oriented programming concepts: data abstraction and encapsulation — objects and classes; inheritance; polymorphism;

Suggested Books:

1. Balagurusamy, Object Oriented Programming with C++, Tata Mcgraw Hill, (2008)
2. J. R. Hubbard, Schaum's outline of theory and problems of programming with C++, Tata McGraw Hill (2000)
3. Behrouz A Forouzan, Forouzan Behrouz, Richard Gilberg, Computer Science: An Object Oriented Approach Using C++, McGraw-Hill (2010)
4. D S Malik, C++ Programming Language, First Indian Reprint, Cengage Learning (2009)
5. R. Albert And T. Breedlove, C++: An Active Learning Approach, Jones And Bartlett India Ltd. (2008)

ELHP-305: Electronics Practical-V
Based on Paper ELHT-301 and CS-1

PRACTICALS Marks: 50

1. To verify and design AND, OR, NOT and XOR gates using NAND gates.
2. To convert a Boolean expression into logic gate circuit and assemble it using logic gate ICs.
3. Design a seven-segment Display driver.
4. Design a Half and Full adder.
5. Design a Half and Full Subtractor.
6. Design a 4x1 Multiplexer using logic gates
7. To build Flip-Flop Circuits using elementary gates (RS, Clocked RS, D-type, and JK Flip-Flop).
8. Design a 4 bit Counter using D/T/ JK Flip-Flop.
9. Design a shift register from D/T/ JK Flip-Flop to study Serial and parallel shifting of data.
10. To design a digital to analog and analog to digital converter of given specifications.

SOFTWARE BASED SIMULATIONS (to run concurrently)

11. Design a seven-segment Display driver.
12. Design a Half and Full adder.
13. Design a Half and Full Subtractor.
14. Design a 4x1 Multiplexer using logic gates
15. To build Flip-Flop Circuits using elementary gates (RS, Clocked RS, D-type, and JK Flip-Flop).
16. Design a 4-bit Counter using D/T/ JK Flip-Flop.
17. Design a shift register from D/T/ JK Flip-Flop to study Serial and parallel shifting of data.
18. To design a digital to analog and analog to digital converter of given specifications.

LABORATORY BASED ON CS

(AS SUGGESTED BY COMPUTER SCIENCE DEPARTMENT)

ELHP-306: Electronic Practical-VI
Based on Paper ELHT-302

PRACTICALS Marks: 50

1. To study the Half wave rectifier and study the effect of C filter.
2. To study the Full wave rectifier and study the effect of C filter.
3. To study Fixed Bias, Voltage divide and Collector-to-Base bias Feedback configuration for transistor.
4. To design a Single Stage CE amplifier for a specific gain and bandwidth.
5. To study Class A, B and C Power Amplifier.
6. To study the Colpitt's and Phase Shift Oscillator.
7. To study the frequency response of Common Source/ Common Gate FET amplifier.

SOFTWARE BASED SIMULATIONS

1. To study the Half wave rectifier and study the effect of C filter
2. To study the Full wave rectifier and study the effect of C filter
3. To study Fixed Bias, Voltage divide and Collector-to-Base bias Feedback configuration for transistor
4. To design a Single Stage CE amplifier for a specific gain and bandwidth
5. To study the Class A, B and C Power Amplifier
6. To study the Colpitt's and Phase Shift Oscillator
7. To study the frequency response of Common Source/ Common Gate-FET amplifier

ELHT-401: Numerical Techniques

THEORY Marks: 100

Unit 1

Numerical Methods: Floating point, Round-off error, Error propagation, Stability, Programming errors.
Solution of Transcendental and Polynomial Equations f(x)=0: Bisection method, Secant and Regula Falsi Methods, Newton Raphson method, Muller Method, Rate of convergence, General Iteration Methods, Newton's Method for Systems, Method for Complex Roots, Roots of Polynomial Equations.

Unit 2

Interpolation and Polynomial Approximations: Taylor Series and Calculation of Functions, Langrange Interpolation, Newton Divided Difference Interpolation (forward and backward difference formulae), Truncation errors.
Curve Fitting: Least square fitting, Curve fitting, Interpolation by Spline functions.

Unit 3

Numerical Integration: Trapezoidal Rule, Error bounds and estimate for the Trapezoidal rule, Simpson's Rule, Error of Simpson's rule, Gauss Integration formula.
Numerical Differentiation: Finite difference method.
Numerical methods for first order differential equations: Euler-Cauchy Method, Heun's Method, Classical Runge Kutta method of fourth order. Methods for system and higher order equations.

Unit 4

Numerical Methods in Linear Algebra: Linear systems Ax=B, Gauss Elimination, Partial Pivoting, LU factorization, Doolittle's, Crout's and Cholesky's method. Matrix Inversion, Gauss-Jordon, Iterative Methods: Gauss-Seidel Iteration, Jacobian Iteration.
Matrix Eigenvalue: Power Method.

Suggested Books:

1. E. Kreyszig , Advanced Engineering Mathematics, John Wiley & Sons (1999).
2. J. H. Mathews and K.D. Fink, Numerical Methods using MATLAB, Prentice Hall India (2005)
3. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods: Problems And Solutions, New Age International (2007)
4. S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall India (2008).
5. A. K. Ghatak, I. C. Goyal and S. J. Chua, Mathematical Physics: Differential Equations and Transform Theory, McMillan India (2006)

ELHT-402: Analog Electronics-II

THEORY Marks: 100

Unit 1

Basic Operational Amplifier: Concept of differential amplifiers, block diagram of an operational amplifier (IC 741),
Op-Amp parameters: input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio.
Op-Amp in open and closed loop configuration: Frequency response of an op-amp in open loop and closed loop configurations, Inverting, Non-inverting, summing and difference amplifier, Integrator, Differentiator, voltage to current converter, current to voltage converter.

Unit 2

Comparators: Basic comparator, Level detector, Voltage limiters, Regenerative comparator.
Signal generators: Phase shift oscillator, Wien bridge oscillator, Schmitt Trigger, Square wave generator, triangle wave generator, sawtooth wave generator, Voltage controlled oscillator (IC 566), Phase locked loops (PLL).

Unit 3

Multivibrators (IC 555): Block diagram, Astable and monostable multivibrator circuit, Voltage to frequency (V/F) and frequency and voltage (F/V) converter.

Unit 4

Signal Conditioning circuits: Sample and hold systems, Active filters: First order low pass and high pass butterworth filter, Second order filters, Band pass filter, Band reject filter, All pass filter, Logarithmic and exponential amplifiers.

Suggested Books:

1. R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education (2003)
2. S. Franco, Design with operational amplifiers and analog integrated circuits, Tata McGraw Hill (2002)
3. R. F. Coughlin and F. F. Driscoll, Operational amplifiers and Linear Integrated circuits, Pearson Education (2001)

ELHT-403: Electromagnetics

THEORY Marks: 100

UNIT 1

Vector Analysis: Scalars and Vectors, Vector Algebra, Rectangular (Cartesian) Coordinate System, Vector Components and Unit Vector, Vector Field, Products, Cylindrical Coordinates, Spherical Coordinates, Differential Length, Area and Volume, Line Surface and Volume integrals, Del Operator, Gradient of a Scalar, Divergence and Curl of a Vector, the Laplacian.
Electrostatic Fields: Coulomb's Law and Electric Field Intensity, Field due to Continuous Charge Distribution, Line and Sheet of Charge. Electric Flux Density, Gauss's Law, Applications of Gauss's Law, Divergence Theorem and Maxwell's First Equation.
Energy and Potential: Energy in moving a point Charge in an Electric Field, Line Integral, Potential Difference and Potential, Potential due to a Point Charge, Potential Field of a System of Charges, Electric Field and Potential, the Dipole, Energy Density in an Electric Field.

UNIT 2

Electric Fields in Conductors: Current and Current Density, Continuity of Current, Metallic Conductors, Conductor Properties and Boundary Conditions, Method of Images.
Dielectric Materials: Polarization in Dielectrics, Dielectric Constant, Linear, Homogeneous, Isotropic and Anisotropic Dielectrics, Boundary Conditions, Capacitance, Capacitance Examples, Capacitance of Two Wire Line.
Poisson's Equation and Laplace's Equation: Derivation of Poisson's and Laplace's equation, Uniqueness Theorem, Examples of Solution of Laplace's Equation: Cartesian, Cylindrical and Spherical Coordinates.

UNIT 3

Magnetostatics: Biot Savert's law, Ampere's Circuital Law, Curl and Stoke's Theorem, Maxwell's Equation, Magnetic Flux and Magnetic Flux Density, The scalar and Vector Magnetic Potentials, Derivation of Biot Savert's and Ampere's Law.
Magnetic Forces and Materials: Force on a moving Charge, Force on a Differential Current Element, Magnetic Torque and Momemt, Magnetic Dipole. Magnetization in Materials and Permeability, Anisotropic materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy, Magnetic Circuits.

UNIT 4

Time Varying Fields: Faraday's and Lenz's Laws of Electromagnetic Induction: a stationary circuit in a time varying Magnetic Field, Transformer, a moving conductor in a Static Magnetic Field. Displacement Current, Maxwell's Equations: point and Integral form. Time Varying Potentials and Lorentz condition (Lorentz Gauge).

Suggested Books:

1. W. H. Hayt and J. A. Buck, Engineering Electromagnetics, Tata McGraw Hill (2006)
2. M. N. O. Sadiku, Elements of Electromagnetics, Oxford University Press (2001)
3. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education (2001)
4. J. A. Edminster, Electormagnetics, Schaum Series, Tata McGraw Hill (2006)
5. N. Narayanrao, Elements of Engineering Electromagnetics, Pearson Education (2006)

CS-2: Data Structures

ADTs and Arrays: Single and Multidimensional arrays, Sequential Allocation
Stacks: Definition of stack, array implementation of stack, conversion of infix expression to prefix, postfix expressions, evaluation of postfix expression
Queues : Definition of Queue, circular queues, priority queues, array implementation of queues
Linked lists : Linked List and its implementation, Link list implementation of stack and queue, Circular and doubly linked list
Searching and sorting: Insertion sort, selection sort, bubble sort, merge sort, Linear Search, binary search.
Trees : Introduction to trees, Binary search tree, preorder, postorder and inorder traversal

Suggested Books

1. Jones and Barlett, Nell Dale, C++ Plus Data Structure (4th Edition)
2. S.Sahni,. Data structures, Algorithms and Applications in C++ by University press (India). Pvt ltd / Orient Longman pvt.ltd., 2nd edition.
3. Adam Drozdek, Data Structures and Algorithms in C++, Second edition, Vikas Publishing House .
4. B.R. Preiss, Data structures and algorithms with object oriented design patterns in C++, John Wiley and Sons, 1999.

ELHP-405: Electronics Practical-VII
Based on Paper ELHT-401 AND CS-2

PRACTICALS Marks: 50

1. To solve Transcendental and Polynomial equations.
2. To find the Complex Roots of equations.
3. Interpolation and Polynomial Approximations.
4. Curve Fitting.
5. Numerical Integration.
6. Numerical Differentiation.
7. Solution of Differentiation Equation
8. To find the Roots of Linear Equations

LABORATORY BASED ON CS-2

(AS SUGGESTED BY COMPUTER SCIENCE DEPARTMENT)

ELHP-406: Electronics Practical-VIII
Based on Paper ELHT-402

PRACTICALS Marks: 50

1. To design an amplifier of given gain for an inverting and non-inverting configuration using an op-amp.
2. To design an integrator using op-amp for a given specification and stud its frequency response.
3. To design a differentiator using op-amp for a given specification and stud its frequency response.
4. To design a First Order Low-pass filter using op-amp.
5. To design a First Order High-pass filter using op-amp.
6. To design a Second Order Low-Pass filter using op-amp.
7. To design a Second Order High-Pass filter using op-amp.
8. To design a Band Pass/ Band Reject filter using op-amp.
9. To design a RC Phase Shift Oscillator using op-amp for a given specification

Software Based Simulations (to run concurrently)

10. To design an amplifier of given gain for an inverting and non-inverting configuration using an op-amp.
11. To design an integrator using op-amp for a given specification and stud its frequency response.
12. To design a differentiator using op-amp for a given specification and stud its frequency response.
13. To design a First Order Low-pass filter using op-amp.
14. To design a First Order High-pass filter using op-amp.
15. To design a Second Order Low-Pass filter using op-amp.
16. To design a Second Order High-Pass filter using op-amp.
17. To design a Band Pass/ Band Reject filter using op-amp.
18. To design a RC Phase Shift Oscillator using op-amp for a given specification

ELHT-501: Microprocessors and Microcontrollers

THEORY Marks: 100

Unit 1

8086 Microprocessor: Internal architecture, Real mode memory addressing, Introduction to protected mode memory addressing, Memory Paging.
Addressing modes: Data-Addressing modes, Program Memory-Addressing modes, Stack Memory-Addressing modes.

Unit 2

Programming 8086 using -
Data movement instructions: MOV, PUSH/POP, Load-Effective Address, String data transfers, miscellaneous data transfer instructions,
Arithmetic and logic instructions: Addition, Subtraction and comparison, Multiplication and division, BCD and ASCII arithmetic, Basic logic instructions, Shift and Rotate, String comparisons.
Program control instructions: Jump group, Controlling the flow of an assembly language program, procedures, Introduction to interrupts, Machine control and miscellaneous instructions
Interrupts: Basic interrupt processing, Interrupt instructions, Operation of real mode and protected mode interrupt, interrupt flag bits, Hardware interrupts, Expanding the interrupt structure.

Unit 3

Peripheral Devices: 8255-Programmable Peripheral Interface, 8253- Programmable interval Timer, 8259-Priority Interrupt Controller, 8279-Programmable Keyboard/Display Interface, 8251- USART, 8237/8257-Programmable DMA Controller.

Unit 4

Other Microprocessors: Introduction to 80186/286/386/486 and Pentium microprocessors. **Introduction to Microcontrollers:** Advantages and Applications of Microcontrollers (8051).

Suggested Books:

1. B. Brey, The Intel Microprocessors- Architecture, Programming and Interfacing, Pearson Education (2003)
2. D. V. Hall, Microprocessors and Interfacing – Programming and Hardware, Tata Mcgraw Hill (1999)

ELHT-502: Analog Communication

THEORY Marks: 100

Unit 1

Introduction: Block diagram of an electronic communication system, electromagnetic spectrum-band designations and applications, need for modulation, concept of channels and base-band signals. Waveform spectra and effect of filtering on complex signals.
Concept of Noise: External noise, internal noise, signal to noise ratio, noise factor, noise temperature, Friss formula.

Unit 2

Amplitude modulation: modulation index, frequency spectrum, generation of AM (balanced modulator, collector modulator), Amplitude Demodulation (diode detector Other forms of AM: Double side band suppressed carrier, DSBSC generation (balanced modulator), Single side band suppressed carrier, SSBSC generation (filter method, phase cancellation method, third method), SSB detection, Introduction to other forms of AM(Pilot Carrier Modulation, Vestigial Side Band modulation, Independent Side Band Modulation).

Unit 3

Angle modulation: Frequency and Phase modulation, modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM (direct and indirect methods), FM detector (slope detector, balanced slope detector, PLL). Comparison between AM, FM and PM.

Unit 4

Transmitters: Communication channels for AM and FM broadcast, AM transmitter: Low level and high level modulation, FM transmitter
Receivers: Receiver parameters: sensitivity, selectivity and fidelity, Super Heterodyne Receiver, Double Conversion Receiver. AM receivers, FM receivers.
Frequency Division Multiplexing.

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Suggested Books:

1) G. Kennedy and B. Davis, Electronic Communication Systems, Tata McGraw Hill (1999)
2) W. Tomasi, Electronic Communication Systems: Fundamentals through Advanced, Pearson Education (2007)
3) R. P. Singh and S. D. Sapre, Communication Systems: Analog and Digital, Tata McGraw Hill (2007)
4) L. E. Frenzel, Communication Electronics: Principles and Applications, Tata McGraw Hill (2002)
5) L. W. Couch II, Digital and Analog Communication Systems, Pearson Education (2005)
6) T. G. Thomas and S. Chandra Sekhar, Communication Theory, Tata McGraw Hill (2006)
7) L. Temes and M. E. Schultz, Schaum's outline of theory and problems of Electronic Communication (1997)

ELHT-503: Electronic Instrumentation

THEORY Marks: 100

Unit 1

Qualities of Measurement: Units: S. I. system of units, dimensions and standards; errors in measurement, types of static error, sources of error, dynamic characteristics and statistical analysis.
Basic Measurement Instruments: DC measurement: dc voltmeter, ohmmeter and ammeter. Digital type voltmeter, ammeter and ohmmeter ,digital multimeter, AC measurement , voltmeter, ammeter. Digital frequency meter: elements of frequency meter, universal counter and its different modes, measurement errors and extending the frequency range. Digital LCR-Q meter, digital wattmeter.

Unit 2

Signal Generators: Types of generators and their operation: Audio oscillator, Function generators, Pulse generators, RF generators, Random noise generators.
Probes and Connectors: Test leads, shielded cables, connectors, low capacitance probes, high voltage probes, RF demodulator probes, special probes for IC's, current probes.

Unit 3

Electronic Displays:The Cathode Ray Oscilloscope (CRO): Block diagram of a General Purpose Oscilloscope and its basic operation, electrostatic focusing and deflection, screen for CRT and graticules, CRT connections, CRO probes. Types of CRO's: dual trace ocilloscope, digital storage oscilloscope.
Wave Analyzers: Operation of frequency selective wave analyzers and heterodyne wave analyzers and their application. Spectrum analyzer.

Unit 4

Transducers: Various types of transducers for measurement of displacement, speed, stress and strain Classification and selection of transducers. Strain Gages: bonded and un-bonded strain gages, strain gage transducer sensitivity. Position Transducer: capacitive, inductive, linear variable differential transformer (LVDT), Piezoelectric, potentiometric. Temperature transducers: Resistance thermometers, thermocouples, thermistor and semiconductor p-n junction transducer. Light Transducers: photoresistors, photovoltaic cells, photodiodes.

Suggested Books:

1. H. S. Kalsi, Electronic Instrumentation, Tata McGraw Hill (2006)
2. Joseph J Carr, Elements of electronic instrumentation and measurement, Pearson Education (2005)
3. C. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata McGraw Hill (1998)
4. H. Cooper, Modern electronic instrumentation and measurement techniques, Pearson Education (2005)
5. R. A. Witte, Electronic test instruments: analog and digital measurements, Tata McGraw Hill (2004)
6. S. Wolf and R. F. M. Smith, Student Reference Manual for Electronic Instrumentation Laboratories, Pearson Education (2004)

ELHT-504: Wave Propagation and Antenna

THEORY Marks: 100

Unit 1

Transmission Lines: Typical transmission lines- Co-axial, Two Wire, Microstrip, Coplanar and Slot Lines, Description of Transmission Line Propagation, Transmission Line Parameters, Distrbuted Line Parameters at High Frequencies for Co-axial, Two Wire and Planar Lines.
Transmission Line Equations: Propagation of Sinusoidal Voltages, Complex Analysis of Sinusoidal Waves and Phasor, Characteristic Impedance, Lossless, Distortionless, low loss lines, Wave Reflection at Discontiniuties, Reflection Coefficient, Voltage Standing Wave Ratio, Input Impedance, Power, Shorted Line, Open-Circuited Line, Matched Line, Transmission Line Applications.

Unit 2

Electromagnetic Wave Propagation: Maxwell's Equations, Time Harmonic Fields, Waves in general, Uniform Plane Wave, Wave propagation in free space, Wave propagation in Dielectrics, Poynting's Theorem and Power, Propagation in Good Conductors, Skin Effect.
Plane Waves in Dispersive Media: Dispersion, phase velocity and group velocity, pulse broadening in dispersive and lossy media.

Unit 3

Reflection of Plane Waves: Reflection of uniform Plane Waves at normal incidence, Plane Wave Propagation in General Direction, Plane Wave Reflection at Oblique Incidence, parallel and perpendicular polarizations.
Waveguides: Description of and dielectric, various waveguides- metallic Parallel Plate metallic Waveguide, TE and TM Modes, Rectangular Waveguide, TE and TM Modes, Cutoff and Dominant Mode, Waveguide Resonators. Mention of Dielectric Waveguides.

Unit 4

Antennas: Wire and Aperture Antennas**,** the Retarded Potential, Hertzian Dipole, Power radiated, Radiation Resistance, Antenna Characteristics, Antenna Patterns, Radiation Intensity, Directive Gain, Power Gain. Effective Area and Friis Equation, The Radar Equation.
Some Practical Antennas: Half-wave Dipole Antenna, Quarter-Wave Monopole Antenna, Small Loop Antenna, Aperture Antenna, Antenna Arrays.

Suggested Books:

1. W. H. Hayt and J.A. Buck, Engineering Electromagnetics, Tata McGraw Hill (2006)
2. M. N. O. Sadiku, Elements of Electromagnetics, Oxford University Press (2001)
3. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education (2001)
4. J. A. Edminster, Electrmagnetics, Schaum Series, Tata McGraw Hill (2006)
5. N. Narayanrao, Elements of Engineering Electromagnetics, Pearson Education (2006)
6. G. S. N. Raju, Antennas and Propagation, Pearson Education (2001)

ELHP-505: Electronics Practical-IX
Based on Paper ELHT-501

PRACTICALS Marks: 50

1. To write an assembly language program to transfer a block of data.
2. To write an assembly language program to add two-8 bit Hexadecimal Numbers
3. To write an assembly language program to multiply two 8-Bit Hexadecimal Numbers
4. To write an assembly language program to add two-16 bit Hexadecimal Numbers
5. To write an assembly language program to multiply two 16-Bit Hexadecimal Numbers
6. To write an assembly language program to convert a 16 Bit Hexadecimal Number to Decimal Number
7. To write an language program to Generate Fibonacci series
8. To write an language program to sort hexadecimal numbers in ascending order
9. To write an assembly language program to sort hexadecimal numbers in descending order
10. To write an assembly language program to Generate Digital Clock.
11. To find the nearest integer value of square root of an integer.
12. To study the working of IC 8255 (Interfacing experiment)
13. To study the working of IC 8253 (Interfacing experiment)
14. To study the working of IC 8259 (Interfacing experiment)
15. To study the working of IC 8279 (Interfacing experiment)
16. To study the working of IC 8251 (Interfacing experiment)

ELHP-506: Electronics Practical-X
Based on Paper ELHT-502 and ELHT-503

PRACTICALS Marks: 50

1. Study of Amplitude Modulation and Demodulation
2. Study of Frequency Modulation and Demodulaton
3. Study of Single Side Band Modulation and Demodulation
4. Study of AM Transmitter and Receiver
5. Study FM Transmitter and Receiver
6. To determine a Low Resistance by Carey Foster's Bridge.
7. To determine the ratio of two capacitances by de Sauty's Bridge.
8. To determine the self inductance of a Coil by Anderson's Bridge using AC.
9. To study the I-V characteristics of Solar Cell
10. To study the variation of thermo-emf of a thermocouple with difference in temperature of its two junctions.
11. To calibrate a thermocouple to measure temperature in a specified range using null method and direct measurement using op-amp.
12. To determine the temperature coefficient of resistance by platinum resistance thermometer.

ELHT-601: Electrical Machines

THEORY Marks: 100

Unit 1

Basics: Basic constructional features and physical principles involved in electrical machines.
D.C. Generators: Principles of operation, lap and wave connections, Coil Span, Commutation Pitch, Resultant Pitch, Numbering of Coil and Commutator segments, Brief ideas about armature reaction and commutation, E.M.F. Equation, Methods of excitation, Characteristics of Self excited and Separately (Shunt, Compound and Series) excited generators, Concept of parallel operations, Losses and efficiency applications.
D.C. Motors: Comparison of generator and motor action, Significance of back EMF, Maximum power, Torque and speed relation, Characteristics of series, shunt and Compound excited, necessity of motor starters, Three point starter, Speed control and applications.

Unit 2

Transformers and Rectifiers: Types of transformers, Transformer Construction, E.m.f. equation, No load operation, Operation under load, Phasor diagram, Transformer Losses, Voltage regulation, condition for maximum efficiency, All day efficiency, Short circuit and open circuit tests, Auto transformers, Polyphase Circuits, Three phase transformers, Delta- Delta and Delta-Y connections, Rectifiers- Three phase rectifiers with filtering circuits.

Unit 3

Poly Phase Induction Motors: General constructional features, Types of motors, Rotating magnetic field, Production of torque, Slip, equivalent circuit, Phasor diagram, Torque equation, Torque-slip characteristics; Effect of rotor resistance, Brief idea of double cage and deep bar rotor motor, Automatic push button and other types of starters, Speed control of induction motors

.Unit 4

Synchronous Machines: Brief construction details of three phase synchronous generators, E.m.f equation, Principle of operation of synchronous motor, Power factor correction.
Single Phase Induction Motors: Construction, principle of operation, classification Lab. Based on starting methods shaded pole, Split phase and capacitor motors, Speed control, Single phase a.c. series motors, Universal motor, Repulsion motor, Reluctance motor, Machines for control applications, Stepper motor.

Suggested Books:

1. G. Mc. Pherson, An introduction to Electrical Machines & Transformers, John Wiley & Sons (1990)
2. H. Cotton, Advanced Electrical Technology, CBS Publishers and Distributors, New Delhi (1984)
3. B. L. Thareja and A. K. Thareja, Electrical Technology, S. Chand & Sons., 23rd Edition
4. I. J. Nagrath and D. P. Kothari, Electrical Machines, Tata McGraw Hill (1997)
5. S. Ghose, Electrical Machines, Pearson Education (2005)
6. N. K. De and P. K. De, Electric Drives, Prentice Hall of India (1999)

ELHT-602: Digital Communication

THEORY Marks: 100

Unit 1

Pulse Analog Modulation: Sampling theorem, Errors in Sampling. Pulse Amplitude Modulation (PAM), Time Division Multiplexing (TDM). Pulse Width Modulation (PWM) and Pulse Position Modulation (PPM). Generation and detection of PAM, PWM, PPM.

Unit 2

Pulse Code Modulation: Need for digital transmission, Quantizing, Uniform and Non-uniform Quantization, Quantization Noise, Companding, Coding, Digital Formats. Decoding, Regeneration, Transmission noise and Bit Error Rate. Differential Pulse Code Modulation, Delta Modulation, Quantization noise, Adaptive Delta Modulation. Time Division Multiplexing (TDM), T1/E1 carrier system.

Unit 3

Digital Carrier Modulation Techniques: Block diagram of digital transmission and reception. Information capacity, Bit Rate, Baud Rate and M-ary coding. Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK).

Unit 4

Multiple Access Techniques: Concept of Frequency Division Multiple Access (FDMA), Code Division Multiple Access (CDMA).
Overview of Modern Communication Systems: Mobile Communication, Satellite Communication and Optical Communication.

Suggested Books:

1. H. Taub and D. Schilling, Principles of Communication Systems, Tata McGraw Hill (1999)
2. W. Tomasi, Electronic Communication Systems: Fundamentals through Advanced, Pearson Education (2004)
3. L. E. Frenzel, Communication Electronics, Principles and Applications, Tata McGraw Hill (2002)
4. L. W. Couch II, Digital and Analog Communication Systems, Pearson Education (2005)
5. H. P. Hsu, Analog and Digital Communications, Tata McGraw Hill (2006)
6. S. Haykin, Communication Systems, Wiley India (2006)

ELHT-603: Optics and Optical electronics

THEORY MARKS: 100

Unit 1

Light as an Electromagnetic Wave: Plane waves in homogeneous media, concept of spherical waves,. Reflection and transmission at an interface, total internal reflection, Brewster's Law. Interaction of electromagnetic waves with dielectrics: origin of refractive index, dispersion.
Interference: Superposition of waves of same frequency, Concept of coherence, Superposition of waves of different frequency, concept of group velocity.
Two beam interference: Division of wavefront, Young's double slit, Fresnel Biprism, Lloyd's mirror; Division of Amplitude, thin film interference, anti-reflecting films, Newton's rings; Michelson interferometer.
Multiple Beam Interference: Fabry Perot interferometer, Resolution and Free Spectral Range; Interference filters.

Unit 2

Diffraction: Huygen Fresnel Principle, Diffraction Integral, Fresnel and Fraunhoffer approximations.
Fraunhoffer Diffraction: Diffraction by a rectangular aperture, single slit, double slit, circular aperture; Resolving power of microscopes and telescopes; Diffraction grating, Resolving power and Dispersive power.
Polarization: Linear, circular and elliptical polarization, polarizer-analyzer and Malus' law; Double refraction by crystals, Interference of polarized light, Half wave and quarter wave plates. Principle of Liquid Crystal Displays.

Unit 3

Geometrical Optics: paraxial optics, imaging by lenses, mirrors system of lenses, cardinal points; real optics: aberrations, chromatic and primary aberration; reduction of aberrations in lens systems; Apertures and Stops, f-number; Simple Optical Instruments, Human Eye, Huygen's and Ramsden's eyepieces, Microscope, Telescope, Camera. Ray optics treatment of guidance in optical fibers.

Unit 4

LEDs: Light Emitting Diodes: principle, structure and materials.
Lasers: Interaction of radiation and matter, Einstein coefficients, Condition for amplification, laser cavity, threshold for laser oscillation, line shape function. Examples of common lasers. The semiconductor injection laser diode. Holography.
Photodetectors: Bolometer, Photomultiplier tubes, Charge Coupled Devices; Photodiodes (p-n, p-i-n, avalanche), quantum efficiency and responsivity.

Suggested Books:

1. R. D. Guenther, Modern Optics, John Wiley & Sons (1990)
2. Ajoy Ghatak, Optics, Tata McGraw Hill, New Delhi (2005)
3. E. Hecht , Optics, Pearson Education Ltd. (2002)
4. J. Wilson and J. F. B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India (1996)
5. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Pearson Education (2009)

ELHT-604: Engineering Mathematics

THEORY Marks: 100

Unit 1

Linear Differential Equations of Second Order and Higher Order: Linear Independence and Dependence, Linear Differential Equations of Second Order with Variable Coefficients, Second Order Differential Equations with Constant Coefficients: Homogeneous, Higher Order Linear Homogeneous Differential Equations, Non-Homogeneous Equations, Differential Equation with Variable Coefficients: Reducible to Equations with Constant Coefficients, Method of Variation of Parameters, Modeling of forced oscillations, Resonance, Electric Circuits, System of Simultaneous Linear Differential Equations with Constant Coefficients.

Unit 2

Series Solutions of Differential Equations and Special Functions: Power Series Method, Legendre Polynomials, Frobenius Method, Bessel's equations and Bessel's functions of first and second kind. Sturm Liouville problems and orthogonal functions. Gamma and Beta Functions.

Unit 3

Partial Differential Equations: Formation of Partial Differential Equation, Partial Differential Equation of First Order, Linear Equations of First Order, Non-linear Partial Differential Equations of First Order, Method of Separation of Variables, Classification of Partial Differential Equations of Second Order. Modeling a Vibrating string and the Wave Equation, Separation of Variables and Use of Fourier series.

Unit 4

Applications of Partial Differential Equations: D'Alembert's Solution of the Wave Equation, Heat Equation: Solution by Fourier Series, Solution by Fourier Integrals and transformation. Membrane, Two Dimensional wave Equation, Rectangular Membrane. Use of Double Fourier Series, Laplacian in Polar Coordinates, Circular Membrane, use of Fourier-Bessel Series, Laplace's Equation in Cylindrical and Spherical Coordinates. Potential, Solution by Laplace Transforms,

Suggested Books:

1. E. Kreyszig, Advanced Engineering Mathematics, Wiley India (2008)
2. B. V. Ramana, Higher Engineering Mathematics, Tata Mc-Graw Hill Publishing Company Limited (2007)
3. R. K. Jain, and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007)
4. C. R. Wylie and L. C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill (2004)

ELHP-605: Electronics Practical-XI
Based on Paper ELHT-601 and ELHT-602

PRACTICALS **Marks: 50**

1. Study of Pulse Amplitude Modulation
2. Study of Pulse Width Modulation
3. Study of Pulse Position Modulation
4. Study of Delta Modulation
5. Study of Pulse Code Modulation
6. Study of Phase Shift Keying, Frequency Shift Keying, Quadrature Phase Shift Keying
7. Study of Time Division Multiplexing
8. Study of single phase rectifier – half wave and full wave
9. To study the I-V Characteristics of SCR
10. To study the I-V Characteristics of Diac and Triac
11. To study Inverter circuit (SCR based) for different configuration
12. To study the characteristics of DC motor – series and shunt
13. To study characteristics of single phase induction motor
14. To study characteristics of three phase induction motor
15. To study control of DC motor by SCR

ELHP-606: Electronics Practical-XII
Based on Paper ELHT-603

PRACTICALS Marks: 50

1. To verify the law of Malus for plane polarized light.
2. To determine refractive index of the material of a given prism using Sodium Light.
3. To determine the resolving power of a prism.
4. To determine wavelength of light using Fresnel Biprism.
5. To determine wavelength of sodium light using Michelson's Interferometer.
6. To determine wavelength of sodium light using Newton's Rings.
7. To determine the resolving power and Dispersive power of Diffraction Grating.
8. Diffraction experiments using a laser.
9. To determine the specific rotation of scan sugar using polarimeter.
10. To analyze elliptically polarized light by using a Babinet's compensator.
11. Characteristics of LEDs and Photodetector.
12. Modulation and Detection of light using LED and Photodetector.
13. To measure the numerical aperture of an optical fiber.
14. Optical Fiber as a sensor.

Syllabus Structure for Semester I-VI [B. Sc. (H) Electronics]

Paper No.	**Semester-I**	**L-T**	**Paper No.**	**Semester-II**	**L-T**
ELHT101	Applied Quantum Mechanics	4-1	ELHT201	Signals and Systems	4-1
ELHT102	Engineering Materials	4-1	ELHT202	Semiconductor Devices	4-1
ELHT103	Network Analysis	4-1	CSAT 201	Computational Skills (***Compulsory)***	4-1
ENAT 101	Technical Writing & Communication in English ***(Compulsory)***	4-1	MAHT 204	Mathematics-I ***(Allied Paper)***	4-1
ELHP105	Electronics Practical-I *Based on ELHT101 and ELHT102*	8 Hours per week	ELHP205	Electronics Practical-III *Based on ELHT201 and CSAT 201*	8 Hours per week
ELHP106	Electronics Practical-II *Based on ELHT103*	8 Hours per week	ELHP206	Electronics Practical-IV *Based on ELHT202*	8 Hours per week

Paper No.	**Semester-III**	**L-T**	**Paper No.**	**Semester-IV**	**L-T**
ELHT301	Digital Electronics	4-1	ELHT401	Numerical Techniques	4-1
ELHT302	Analog Electronics-I	4-1	ELHT402	Analog Electronics-II	4-1
MAHT 305	Mathematics-II ***(Allied Paper)***	4-1	ELHT403	Electromagnetics	4-1
CS-1	Fundamental of Programming Languages ***(Allied Paper)***	4-1	CS-2	Data Structures ***(Allied Paper)***	4-1
ELHP305	Electronics Practical-V *Based on ELHT301& CS-1*	8 Hours per week	ELHP405	Electronics Practical-VII *Based on ELHT401 and CS-2*	8 Hours per week
ELHP306	Electronics Practical-VI *Based on ELHT302*	8 Hours per week	ELHP406	Electronics Practical-VIII *Based on ELHT402*	8 Hours per week

Paper No.	**Semester-V**	**L-T**	**Paper No.**	**Semester-VI**	**L-T**
ELHT501	Microprocessors and Microcontrollers	4-1	ELHT601	Electrical Machines	4-1
ELHT502	Analog Communication	4-1	ELHT602	Digital Communication	4-1
ELHT503	Electronic Instrumentation	4-1	ELHT603	Optics and Optical Electronics	4-1
ELHT504	Wave Propagation and Antenna	4-1	ELHT604	Engineering Mathematics	4-1
ELHP505	Electronics Practical-IX *Based on ELHT501*	8 Hours per week	ELHP605	Electronics Practical-XI *Based on ELHT601 and ELHT602*	8 Hours per week
ELHP506	Electronics Practical-X *Based on ELHT502 and ELHT503*	8 Hours per week	ELHP606	Electronics Practical-XII *Based on ELHT603*	8 Hours per week

L – Lecture T – Tutorial P - Practical

Courses with 4L and 1T : 4 Credits
Courses with 8 hrs. Practicals : 4 Credits (2hrs lab equivalent to 1 Credit)