Syllabus

Programme: B. Sc. (HONOURS) Electronic Science

CHOICE BASED CREDIT SYSTEM

Department of Electronics
J. B. College (Autonomous), Jorhat, Assam

Programme: B. Sc. (HONOURS) Electronic Science

Programme Objectives:

- To provide a platform to build-up knowledge from basic level to career-oriented skills in the field of electronics and to generate manpower to be ideally suited for taking up the tasks in Electronics.
- To mould the students to survive with an outstanding career-oriented base to meet the growing challenges with an adequate understanding of scientific research, software to hands-on skills.
- To train the students to work professionally in one or more of the following areas: analog electronics, digital electronics, communication systems, photonics, microprocessor and microcontroller, Nanoelectronics, power electronics, semiconductor devices, biomedical instrumentations and circuit designing and analysis with software.
- To skill the student on Matlab, SciLab, Proteus, VHDL, Multisim, SimuLED, JAVA, C language, fabrication of Printed Circuit Boards and embedded system for solving different applied problems.
- To create strong foundations to qualify them for continuing education, synthesizing analytical competence, technical skills, and scientific research intellect.
- To produce graduate with up-to-date technical skill, adequate communication skill, and team work capability to serve in the electronics and information technology based organizations in India and abroad in teaching, research, industries and allied sectors.
- To provide training in industries, research laboratories and universities/institutions for latest development of their respective fields.

Programme Outcomes:

An outcome describes the various features of Student's abilities to do by the time of graduation:

- Develop deep understanding of working and principles of various electronics circuits.
- Develop an ability to use the techniques, skills, and modern electronics tools and devices and software.
- Able to design and conduct experiments, as well as to analyze and interpret data.
- Understand the basic concept of circuits, various semiconductor devices, sensors and Transducers, communication system and optoelectronics devices like Laser, LEDs, Photodetector, LCD, Guided Waves and the Optical Fiber different modern instruments etc. and their applications in different fields.
- Become skilled in Matlab, SciLab, Proteus, VHDL, Multisim, SimuLED, JAVA, C language, fabrication of Printed Circuit Boards and embedded systems for solving mathematical/applied problems.
- Gain an ability to identify, formulate, and solve electronics related problems.
- Enhance communication skills and team work capability by attending seminars, group discussions, interactive sessions etc.
- Know the latest development in industries, research and teaching by attending internship in different industries, research laboratories and universities/institutions of state and national level.

Course Structure- ELECTRONIC SCIENCE (Honours)

Seme-ster	Course No	Course Code	Course Title	Course Type	Marks Distributions					Remarks
					TH	TH-IA	PR	PR-IA	Total	
1st	C-01	ELTC-101	Basic Circuit Theory and Network Analysis	Theory + Practical	50	15	30	05	100	
	C-02	ELTC-102	Mathematics Foundation for Electronics	Theory + Practical	50	15	30	05	100	
2nd	C-03	ELTC-201	Semiconductor Devices	Theory + Practical	50	15	30	05	100	
	C-04	ELTC-202	Applied Physics	Theory + Practical	50	15	30	05	100	
3rd	C-05	ELTC-301	Electronic Circuits	Theory + Practical	50	15	30	05	100	
	C-06	ELTC-302	Digital Electronics and VHDL	Theory + Practical	50	15	30	05	100	
	C-07	ELTC-303	C Programming and Data Structures	Theory + Practical	50	15	30	05	100	
	SEC01A	ELTS-301	Design and Fabrication of Printed Circuit Boards	Project*			40	10	50	Ongoing
	SEC01B	ELTS-302	Mobile Applications and Development	Project and Viva	40 (Project)		10 (IA/VV)		50	
4th	C-08	ELTC-401	Operational Amplifiers and Applications	Theory + Practical	50	15	30	05	100	
	C-09	ELTC-402	Signals and Systems	Theory + Practical	50	15	30	05	100	
	C-10	ELTC-403	Electronic Instrumentation	Theory + Practical	50	15	30	05	100	
	SEC02.A	ELTS-401	Internet Technologies	Project			40*	10	50	Ongoing
	SEC02.B	ELTS-402	Programming with Lab View	Project			40*	10	50	
5th	C-11	ELTC-501	microprocessor and microcontroller	Theory + Practical	50	15	30	05	100	
	C-12	ELTC-502	Electromagnetics	Theory + Practical	50	15	30	05	100	
	DSE01A	ELTD-501(A)	Numerical Analysis	Theory + Practical	50	15	30	05	100	Ongoing
	DSE01B	ELTD-501(B)	Digital Signal Processing	Theory + Practical	50	15	30	05	100	
	DSE02A	ELTD-502(A)	Computer Networks	Theory + Practical	50	15	30	05	100	Ongoing
	DSE02B	ELTD-502(B)	Power Electronics	Theory + Practical	50	15	30	05	100	
6th	C-13	ELTC-601	Communication Electronics	Theory + Practical	50	15	30	05	100	
	C-14	ELTC-602	Photonics	Theory + Practical	50	15	30	05	100	
	DSE03A	ELTD-601(A)	Semiconductor Fabric-ation & Characterization	Theory + Practical	50	15	30	05	100	Ongoing
	DSE03B	ELTD-601(B)	Nanoelectronics	Theory + Practical	50	15	30	05	100	
	DSE04A	ELTD-602(A)	Embedded Systems	Theory + Practical	50	15	30	05	100	
	DSE04B	ELTD-602(B)	Biomedical Instrumentation	Theory + Practical	50	15	30	05	100	

	DSE04C	ELTD-602(C)	Dissertation/Project	Report and Viva		80** 20		100	
*Project: 40 (Report-25, Presentation and Viva voce-15); IA-10; **Project: 80 (Report-50, Presentation and Vivavoce-30); IA-20									
Generic Elective-Electronic Science									
1st	GE-01	ELTG101	Electronics Circuits and PCB Designing	Theory + Practical	50	15	30	05	100	
2nd	GE-02	ELTG201	Digital System Design	Theory + Practical	50	15	30	05	100	
3rd	GE-03	ELTG301	Instrumentation	Theory + Practical	50	15	30	05	100	
4th	GE-04	ELTG401	Consumer Electronic	Theory + Practical	50	15	30	05	100	

Detailed Syllabus for Core Course
B.Sc. (Honours) Electronic Science

Semester-I
COURSE TITLE: BASIC CIRCUIT THEORY AND NETWORK ANALYSIS
Course code: ELTC-101 **Course No: C-01**
Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:
The given paper is to impart the basic concept of circuits and its analysis for both AC and DC. This course helps students to simplify complicated circuits with network theorem and includes familiarization with various electronic components and verification of different network theorems.

Unit- 1 (13 Lectures, 10 Marks)
Basic Circuit Concepts: Voltage and Current Sources, Resistors: Fixed and Variable resistors, Construction and Characteristics, Color coding of resistors, resistors in series and parallel.
Inductors: Fixed and Variable inductors, Self and mutual inductance, Faraday's law and Lenz's law of electromagnetic induction, Energy stored in an inductor, Inductance in series and parallel, Testing of resistance and inductance using multimeter.
Capacitors: Principles of capacitance, Parallel plate capacitor, Permittivity, Definition of Dielectric Constant, Dielectric strength, Energy stored in a capacitor, Air, Paper, Mica, Teflon, Ceramic, Plastic and Electrolytic capacitor, Construction and application, capacitors in series and parallel, factors governing the value of capacitors, testing of capacitors using multimeter.

Unit- 2 (13 Lectures, 10 Marks)
Circuit Analysis: Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node Analysis, Mesh Analysis, Star-Delta Conversion.
DC Transient Analysis: RC Circuit- Charging and discharging with initial charge, RL Circuit with Initial Current, Time Constant, RL and RC Circuits with Sources, DC Response of Series RLC Circuits.

Unit-3 (18 Lectures, 15 Marks)
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, 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 **(qualitative ideas only).**

Unit-4 (16 Lectures, 15 Marks)
Network Theorems: Principal of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Millman's Theorem, Maximum Power Transfer Theorem. AC circuit analysis using Network theorems.

Two Port Networks: Impedance (Z) Parameters, Admittance (Y) Parameters, Transmission (ABCD) Parameters.

Suggested books:

1. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)
2. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill.(2005)
3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
4. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005)
5. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Basic Circuit Theory and Network Analysis Lab (Hardware and Circuit Simulation Software)
60 Periods

1. Familiarization with
    a) Resistance in series, parallel and series – Parallel.
    b) Capacitors & Inductors in series & Parallel.
    c) Multimeter – Checking of components.
    d) Voltage sources in series, parallel and series – Parallel
    e) Voltage and Current dividers

2. Measurement of Amplitude, Frequency & Phase difference using CRO.
3. Verification of Kirchoff's Law.
4. Verification of Norton's theorem.
5. Verification of Thevenin's Theorem.
6. Verification of Superposition Theorem.
7. Verification of the Maximum Power Transfer Theorem.
8. RC Circuits: Time Constant, Differentiator, Integrator.
9. Designing of a Low Pass RC Filter and study of its Frequency Response.
10. Designing of a High Pass RC Filter and study of its Frequency Response.
11. Study of the Frequency Response of a Series LCR Circuit and determination of its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.

Detailed Syllabus for Core Course
B.Sc. (Honours) Electronic Science

Semester-I

COURSE TITLE: MATHEMATICS FOUNDATION FOR ELECTRONICS

Course code: ELTC-102 **Course No:C-02**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:

This course includes a detailed understanding of differential equations, matrices, and complex variables, and functions. This course will help students to improve the understanding of mathematical foundation for electronics and simplifications by using mathematical simulation tools like Matlab/SciLab.

Unit-1 (16 Lectures, 15 Marks)

Ordinary Differential Equations: First Order Ordinary Differential Equations, Basic Concepts, Separable Ordinary Differential Equations, Exact Ordinary Differential Equations, Linear Ordinary Differential Equations. Second Order homogeneous and non-homogeneous Differential Equations.Series solution 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. Error functions and gamma function (ideas only).

Unit- 2 (14 Lectures, 10 Marks)

Matrices: Introduction to Matrices, System of Linear Algebraic Equations, Gaussian Elimination Method, Gauss -Seidel Method, LU decomposition, Solution of Linear System by LU decomposition. Eigen Values and Eigen Vectors, Linear Transformation, Properties of Eigen Values and Eigen Vectors, Cayley-Hamilton Theorem, Diagonalization, Powers of a Matrix. Real and Complex Matrices, Symmetric, Skew Symmetric, Orthogonal Quadratic Form, Hermitian, Skew Hermitian, Unitary Matrices.

Unit-3 (14 Lectures, 10 Marks)

Sequences and series: Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a sequence, Infinite series, Necessary condition for Convergence, Cauchy's Integral Test, D'Alembert's Ratio Test, Cauchy's nth Root Test, Alternating Series, Leibnitz's Theorem, Absolute Convergence and Conditional Convergence, Power Series.

Unit-4 (16 Lectures, 15 Marks)

Complex Variables and Functions: Complex Variable, Complex Function, Continuity, Differentiability, Analyticity. Cauchy-Riemann (C- R) Equations, Harmonic and Conjugate Harmonic Functions, Exponential Function, Trigonometric Functions, Hyperbolic Functions. Line Integral in Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivative of Analytic Functions. Sequences, Series and Power Series, Taylor's Series, Laurent Series, Zeroes and Poles. Residue integration method, Residue integration of real Integrals.

Suggested Books

1. E. Kreyszig, advanced engineering mathematics, Wiley India (2008)
2. Murray Spiegel, Seymour Lipschutz, John Schiller, Outline of Complex Variables, Schaum Outline Series, Tata McGraw Hill (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)
5. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Limited (2007)

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Mathematics Foundation for Electronics Lab (Scilab/MATLAB/ any other Mathematical Simulation software)

60 Periods

1. Solution of First Order Differential Equations
2. Solution of Second Order homogeneous Differential Equations
3. Solution of Second Order non-homogeneous Differential Equations
4. Convergence of a given series.
5. Divergence of a given series.
6. Solution of linear system of equations using Gauss Elimination method.
7. Solution of linear system of equations using Gauss – Seidel method.
8. Solution of linear system of equations using L-U decomposition method.

Detailed Syllabus for Core Course
B.Sc. (Honours) Electronic Science

Semester-II
COURSE TITLE: SEMICONDUCTOR DEVICES
Course code: ELTC-201 **Course No:C-03**
Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:
This course ensures a basic knowledge of fundamental of crystal structures and various semiconductor devices like p-n junction diodes, BJT, FET and power devices. The course also includes basic understanding of semiconductor devices and their characteristics using hardware and circuit simulation software tools.

Unit 1 (14 Lectures, 15 Marks)
Semiconductor Basics: Introduction to Semiconductor Materials, Crystal Structure, Planes and Miller Indices, Energy Band in Solids, Concept of Effective Mass, Density of States, Carrier Concentration at Normal Equilibrium in Intrinsic Semiconductors, Derivation of Fermi Level for Intrinsic & Extrinsic Semiconductors, Donors, Acceptors, Dependence of Fermi Level on Temperature and Doping Concentration, Temperature Dependence of Carrier Concentrations.
Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect, Diffusion Process, Einstein Relation, Current Density Equation, Carrier Injection, Generation And Recombination Processes, Continuity Equation.

Unit 2 (14 Lectures, 10 Marks)
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 an P-N Junction. Concept of Linearly Graded Junction, Derivation of Diode Equation and I-V Characteristics. Zener and Avalanche Junction Breakdown Mechanism.
Tunnel diode, varactor diode, solar cell: circuit symbol, characteristics, applications.

Unit 3 (14 Lectures, 10 Marks)
Bipolar Junction Transistors (BJT): PNP and NPN Transistors, Basic Transistor Action, Emitter Efficiency, Base Transport Factor, Current Gain, Energy Band Diagram of Transistor in Thermal Equilibrium, Quantitative Analysis of Static Characteristics (Minority Carrier Distribution and Terminal Currents), Base-Width Modulation, Modes of operation, Input and Output Characteristics of CB, CE and CC Configurations.
Metal Semiconductor Junctions: Ohmic and Rectifying Contacts.

Unit 4 (18 Lectures, 15 Marks)
Field Effect Transistors: JFET, Construction, Idea of Channel Formation, Pinch-Off and Saturation Voltage, Current-Voltage Output Characteristics. MOSFET, types of MOSFETs, Circuit symbols, Working and Characteristic curves of Depletion type MOSFET (both N channel

and P Channel) and Enhancement type MOSFET (both N channel and P channel). Complimentary MOS (CMOS).

Power Devices: UJT, Basic construction and working, Equivalent circuit, intrinsic Standoff Ratio, Characteristics and relaxation oscillator-expression. SCR, Construction, Working and Characteristics, Triac, Diac, Circuit symbols, Basic constructional features, Operation and Applications.

Suggested Books:

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

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Semiconductor Devices Lab (Hardware and Circuit Simulation Software)

60 Periods

1. Study of the I-V Characteristics of Diode – Ordinary and Zener Diode.
2. Study of the I-V Characteristics of the CE configuration of BJT and obtain ri, ro, β.
3. Study of the I-V Characteristics of the Common Base Configuration of BJT and obtain ri, ro, α.
4. Study of the I-V Characteristics of the Common Collector Configuration of BJT and obtain voltage gain, ri, ro.
5. Study of the I-V Characteristics of the UJT.
6. Study of the I-V Characteristics of the SCR.
7. Study of the I-V Characteristics of JFET.
8. Study of the I-V Characteristics of MOSFET.
9. Study of Characteristics of Solar Cell.
10. Study of Hall Effect.

Detailed Syllabus for Core Course
B.Sc. (Honours) Electronic Science

Semester-II

COURSE TITLE: APPLIED PHYSICS

Course code: ELTC-202 **Course No:C-04**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:

To induce basic concept of quantum physics to the students. This course deals with various concepts under mechanical, thermal, electrical and magnetic properties of materials as well as evaluating some important physical phenomena using experimental setups.

Unit-1 (19 Lectures, 15 Marks)

Quantum Physics: Inadequacies of Classical physics. Compton's effect, Photo-electric Effect, Wave-particle duality, de Broglie waves. 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 Schrodinger wave equation, Stationary states, Eigen-values and Eigen functions. Particle in a one-dimensional box, Extension to a three dimensional box, Potential barrier problems, phenomenon of tunneling. Kronig Penney Model and development of band structure.

Unit-2 (11 Lectures, 10 Marks)

Mechanical Properties of Materials: 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.

Unit-3 (15 Lectures, 10 Marks)

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-4 (15 Lectures, 15 Marks)

Electric and Magnetic 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.

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.

Suggested Books:

1. S. Vijaya and G. Rangarajan, Material Science, Tata Mcgraw Hill (2003)
2. W. E. Callister, Material Science and Engineering: An Introduction, Wiley India (2006)
3. A. Beiser, Concepts of Modern Physics , McGraw-Hill Book Company (1987)
4. A. Ghatak & S. Lokanathan, Quantum Mechanics: Theory and Applications, Macmillan India (2004)

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Applied Physics Lab

60 Periods

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 value of Boltzmann Constant by studying forward characteristics of diode.
6. To determine the value of Planck's constant by using LEDs of at least 4 different wavelengths.
7. To determine e/m of electron by Bar Magnet or by Magnetic Focusing.

Detailed Syllabus for Core Course
B.Sc. (Honours) Electronic Science

Semester-III
COURSE TITLE: ELECTRONICS CIRCUITS
Course code: ELTC-301 **Course No: C-05**
Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:
The objective of the course is focused on deep understanding on diode circuits, bipolar junction transistors, amplifiers, oscillators and MOSFET circuits. This paper also gives better perception in electronic circuit analysis by hardware and circuit simulation software.

Unit- 1 (14 Lectures, 10 Marks)
Diode Circuits: Ideal diode, piecewise linear equivalent circuit, dc load line analysis, Quiescent (Q) point. Clipping and clamping circuits. Rectifiers: HWR, FWR (center tapped and bridge). Circuit diagrams, working and waveforms, ripple factor & efficiency, comparison. Filters: types, circuit diagram and explanation of shunt capacitor filter with waveforms.
Zener diode regulator circuit diagram and explanation for load and line regulation, disadvantages of Zener diode regulator.

Unit- 2 (15 Lectures, 15 Marks)
Bipolar Junction Transistor: Review of CE, CB Characteristics and regions of operation. Hybrid parameters. Transistor biasing, DC load line, operating point, thermal runaway, stability and stability factor, Fixed bias without and with RE, collector to base bias(basic idea), voltage divider bias and emitter bias(basic idea) (+VCC and –VEE bias), circuit diagrams and their working.
Transistor as a switch, circuit and working**,** Darlington pair and its applications.
BJT amplifier (CE), dc and ac load line analysis, hybrid model of CE configuration, Quantitative study of the frequency response of a CE amplifier, Effect on gain and bandwidth for Cascaded CE amplifiers (RC coupled).

Unit- 3 (13 Lectures, 10 Marks)
Feedback Amplifiers: Concept of feedback, negative and positive feedback, advantages and disadvantages of negative feedback, voltage (series and shunt), current (series and shunt) feedback amplifiers, gain, input and output impedances . Barkhausen criteria for oscillations, Study of phase shift oscillator, Colpitts oscillator and Hartley oscillator.

Unit- 4 (18 Lectures, 15 Marks)
MOSFET Circuits: Review of Depletion and Enhancement MOSFET, Biasing of MOSFETs, Small Signal Parameters, Common Source amplifier circuit analysis, CMOS circuits.
Power Amplifiers: Difference between voltage and power amplifier, classification of power amplifiers, Class A, Class B, Class C and their comparisons.

Operation of a Class A single ended power amplifier. Operation of Transformer coupled Class A power amplifier, overall efficiency. push pull amplifier, crossover distortion, heat sinks.
Single tuned amplifiers: Circuit diagram, Working principle and Frequency Response of different single tuned amplifier, Limitations of single tuned amplifier, Applications in communication circuits.

Suggested Books:

1. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky, 9th Edition, 2013, PHI

2. Electronic devices, David A Bell, Reston Publishing Company
3. D. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGraw Hill (2002)
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. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill (2010)
7. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)
8. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Electronics Circuits Lab (Hardware and Circuit Simulation Software)

60 Periods

1. Study of the half wave rectifier and Full wave rectifier.
2. Study of power supply using C filter and Zener diode.
3. Designing and testing of 5V/9 V DC regulated power supply and find its load-regulation
4. Study of clipping and clamping circuits .
5. Study of Fixed Bias, Voltage divider and Collector-to-Base bias Feedback configuration for transistors.
6. Designing of a Single Stage CE amplifier.
7. Study of Class A, B and C Power Amplifier.
8. Study of the Colpitt's Oscillator.
9. Study of the Hartley's Oscillator.
10. Study of the Phase Shift Oscillator
11. Study of the frequency response of Common Source FET amplifier.

Detailed Syllabus for Core Course
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Semester-III

COURSE TITLE: DIGITAL ELECTRONICS AND VERILOG/VHDL

Course code: ELTC-302 **Course No: C-06**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:

This course provides a basic concept on digital world. With this paper, students can have a glimpse of digital number systems, coding, logic gates and digital algebra to implement in electronic devices. This course also includes basic introduction to VHDL and realizing basic digital circuits by VHDL coding, with circuit simulation software as well as in hardware lab.

Unit-1 (11 Lectures, 10 Marks)

Number System and Codes: Decimal, Binary, Hexadecimal and Octal number systems, base conversions, Binary, octal and hexadecimal arithmetic (addition, subtraction by complement method, multiplication), representation of signed and unsigned numbers, Binary Coded Decimal code.

Logic Gates and Boolean algebra: Introduction to Boolean Algebra and Boolean operators, Truth Tables of OR, AND, NOT, Universal gates. Basic postulates and fundamental theorems of Boolean algebra, Truth tables, construction and symbolic representation of XOR, XNOR.

Digital Logic families: Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Speed power product, TTL and CMOS families and their comparison.

Unit-2 (13 Lectures, 10 Marks)

Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS), Karnaugh map minimization, Encoder and Decoder, Multiplexers and Demultiplexers, Implementing logic functions with multiplexer, binary Adder, binary subtractor, parallel adder/subtractor.

Unit- 3 (18 Lectures, 15 Marks)

Sequential logic design: Latches and Flip flops , S-R Flip flop, J-K Flip flop, T and D type Flip flop, Clocked and edge triggered Flip flops, master slave flip flop, Registers, Counters (synchronous and asynchronous and modulo-N), State Table, State Diagrams, counter design using excitation table and equations. , Ring counter and Johnson counter.

Programmable Logic Devices: Basic concepts- ROM, PLA, PAL, CPLD, FPGA (basic idea).

Unit-4 (18 Lectures, 15 Marks)

Introduction to Verilog: An introduction to HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches. Verilog Modules, Delays, data flow style, behavioral style, structural style, mixed design style, simulating design. Introduction to Language Elements, Keywords, Identifiers, White Space Characters, Comments,

format, Integers, reals and strings. Logic Values, Data Types-net types, undeclared nets, scalars and vector nets, Register type, Parameters. Expressions, Operands, Operators, types of Expressions.

Data flow Modeling and Behavioral Modeling:

Data flow Modeling: Continuous assignment, net declaration assignments, delays, net delays.

Behavioral Modeling: Procedural statement, procedural constructs, timing controls, block statement, procedural assignments, conditional statement, loop statement, procedural continuous assignment.

Gate level modeling – Introduction to gate level modeling, built in Primitive Gates, multiple input gates, Tri-state logic gates, pull gates, MOS switches, bidirectional switches, gate delay, array instances, and implicit nets, Illustrative Examples (both combinational and sequential logic circuits).

OR

Introduction to VHDL: A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches. VHDL Modules, Delays, data flow style, behavioral style, structural style, mixed design style, simulating design.

Introduction to Language Elements, Keywords, Identifiers, White Space Characters, Comments, format. VHDL terms, describing hardware in VHDL, entity, architectures, concurrent signal assignment, event scheduling, statement concurrency, structural designs, sequential behavior, process statements, process declarative region, process statement region, process execution, sequential statements, architecture selection, configuration statements, power of configurations.

Behavioral Modeling: Introduction to behavioral modeling, inertial delay, transport delay , inertial delay model, transport delay model, transport vs inertial delay, simulation delta drivers, driver creation, generics, block statements, guarded blocks.

Sequential Processing: Process statement, sensitivity list, signal assignment vs variable assignment, sequential statements, IF, CASE ,LOOP, NEXT, ,EXIT and ASSERT statements, assertion BNF, WAIT ON signal, WAIT UNTIL expression, WAIT FOR time expression, multiple wait conditions, WAIT Time-Out, Sensitivity List vs WAIT Statement Concurrent Assignment, Passive Processes.

Data types: Object types-signal, variable, constant, Data types –scalar types, composite types, incomplete types, File Type caveats, subtypes, Subprograms and functions.

Suggested Books:

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
5. A Verilog HDL Primer – J. Bhasker, BSP, 2003 II Edition.
6. Verilog HDL-A guide to digital design and synthesis-Samir Palnitkar, Pearson, 2nd edition.

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Digital Electronics and Verilog/VHDL Lab (Hardware and Circuit Simulation Software)
60 Periods

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 IC's.
3. Design a Half and Full Adder.
4. Design a Half and Full Subtractor.
5. Design a seven segment display driver.
6. Design a 4 X 1 Multiplexer using gates.
7. To build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type).
8. Design a counter using D/T/JK Flip-Flop.
9. Design a shift register and study Serial and parallel shifting of data.

Experiments in Verlog/VHDL

1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder using basic and derived gates.
3. Half subtractor and Full Subtractor using basic and derived gates.
4. Clocked D FF, T FF and JK FF (with Reset inputs).
5. Multiplexer (4x1, 8x1) and Demultiplexer using logic gates.
6. Decoder (2x4, 3x8), Encoders and Priority Encoders.
7. Design and simulation of a 4 bit Adder.
8. Code converters (Binary to Gray and vice versa).
9. 2 bit Magnitude comparator.
10. 3 bit Ripple counter.

Detailed Syllabus for Core Course
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Semester-III

COURSE TITLE: C PROGRAMMING AND DATA STRUCTURES

Course code: ELTC-303 **Course No: C-07**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:

C Programming and Data Structures paper benefit student to introduce them to importance of learning programming language. The course comprises grasp of basic concept of C programming, various advanced features, declaration and data structures.

Unit- 1 (12 Lectures, 10 Marks)

C Programming Language: Introduction, Importance of C, Character set, Tokens, keywords, identifier, constants, basic data types, variables: declaration & assigning values. Structure of C program, Arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, bit wise operators, expressions and evaluation of expressions, type cast operator, implicit conversions, precedence of operators. Arrays-concepts, declaration, accessing elements, storing elements, two-dimensional and multi-dimensional arrays. Input output statement and library functions (math and string related functions).

Unit-2 (19 Lectures, 15 Marks)

Decision making, branching & looping: If, if-else, else-if, switch statement, break, for loop, while loop and do loop.

Functions: Defining functions, function arguments and passing, returning values from functions.

Structures: Defining and declaring a structure variables, accessing structure members, initializing a structure, copying and comparing structure variables, array of structures, arrays within structures, structures within structures, structures and functions. Pointers.

Introduction to C++: Object oriented programming, Definition of an object-oriented language.

Unit-3 (15 Lectures, 13 Marks)

Data Structures: Definition of stack, array implementation of stack, conversion of infix expression to prefix, postfix expressions, evaluation of postfix expression. Definition of Queue, Circular queues, Array implementation of queues. Linked List and its implementation, Link list implementation of stack and queue, Circular and doubly linked list.

Unit-4 (14 Lectures, 12 Marks)

Searching and sorting: Insertion sort, selection sort, bubble sort, merge sort, linear Search, binary search. **Trees :** Introduction to trees, Binary search tree, Insertion and searching in a BST, preorder, postorder and inorder traversal (recursive)

Suggested Books:

1. Yashavant Kanetkar, Let Us C , BPB Publications
2. Programming in ANSI C, Balagurusamy, 2nd edition, TMH.
3. Byron S Gottfried, Programming with C , Schaum Series
4. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, Prentice Hall
5. Yashavant Kanetkar, Pointers in C, BPB Publications
6. S. Sahni and E. Horowitz, "Data Structures", Galgotia Publications
7. Tanenbaum: "Data Structures using C", Pearson/PHI.
8. Ellis Horowitz and Sartaz Sahani "Fundamentals of Computer Algorithms", Computer Science Press.

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

C Programming and Data Structures Lab

60 Periods

1. Generate the Fibonacci series up to the given limit N and also print the number of elements in the series.
2. Find minimum and maximum of N numbers.
3. Find the GCD of two integer numbers.
4. Calculate factorial of a given number.
5. Find all the roots of a quadratic equation $Ax^2 + Bx + C = 0$ for non – zero coefficients A, B and C. Else report error.
6. Calculate the value of sin (x) and cos (x) using the series. Also print sin (x) and cos (x) value using library function.
7. Generate and print prime numbers up to an integer N.
8. Sort given N numbers in ascending order.
9. Find the sum & difference of two matrices of order MxN and PxQ.
10. Find the product of two matrices of order MxN and PxQ.
11. Find the transpose of given MxN matrix.
12. Find the sum of principle and secondary diagonal elements of the given MxN matrix.
13. Calculate the subject wise and student wise totals and store them as a part of the structure.
14. Maintain an account of a customer using classes.
15. Implement linear and circular linked lists using single and double pointers.
16. Create a stack and perform Pop, Push, Traverse operations on the stack using Linear Linked list
17. Create circular linked list having information about a college and perform Insertion at front, Deletion at end.
18. Create a Linear Queue using Linked List and implement different operations such as Insert, Delete, and Display the queue elements.
19. Implement polynomial addition and subtraction using linked lists.
20. Implement sparse matrices using arrays and linked lists.

21. Create a Binary Tree to perform Tree traversals (Preorder, Postorder, Inorder) using the concept of recursion.
22. Implement binary search tree using linked lists. Compare its time complexity over that of linear search.
23. Implement Insertion sort, Merge sort, Bubble sort, Selection sort.

Detailed Syllabus for Core Course
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Semester-IV

COURSE TITLE: OPERATIONAL AMPLIFIERS AND APPLICATIONS

Course code: ELTC-401 **Course No: C-08**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:

This course focused specifically on Operational Amplifiers and Applications. The content of the paper will help students to have an extensive concept of Op-Amps and also ability to design various circuits using Op-Amps.

Unit-1 (18 Lectures, 15 Marks)

Basic Operational Amplifier: Concept of differential amplifiers (Dual input balanced and unbalanced output), constant current bias, current mirror, cascaded differential amplifier stages with concept of level translator, block diagram of an operational amplifier (IC 741),characteristics of OPAMP under ideal conditions.

Op-Amp parameters: Input offset voltage, input offset current, differential input resistance, common mode rejection ratio (CMRR), slew rate.

Unit-2 (18 Lectures, 15 Marks)

Op-Amp Circuits: 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, Log and Antilog amplifier.

Comparators: Basic comparator, Level detector, Voltage limiters, Schmitt Trigger.

Signal generators: Phase shift oscillator, Wein bridge oscillator, Square wave generator, triangle wave generator, saw tooth wave generator, and Voltage controlled oscillator(IC 566).

Unit-3 (12 Lectures, 10 Marks)

Multivibrators (IC 555): Astable and monostable multivibrator, Applications of Monostable and Astable multivibrators. Phase locked loops (PLL)(basic idea), **IC voltage regulators:** IC 78xx and IC 79xx, IC LM 317 -concepts only.

Unit-4 (12 Lectures, 10 Marks)

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

Suggested Books:

1. R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education (2003)
2. R. F. Coughlin and F. F. Driscoll, Operational amplifiers and Linear Integrated circuits, Pearson Education (2001)
3. J. Millman and C.C. Halkias, Integrated Electronics, Tata McGraw-Hill,(2001)
4. A.P.Malvino, Electronic Principals,6th Edition , Tata McGraw-Hill,(2003)
5. K.L.Kishore,OP-AMP and Linear Integrated Circuits, Pearson(2011)

Pratical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Operational Amplifiers and Application Lab (Hardware and Circuit Simulation Software)

60 Periods

1. Study of op-amp characteristics: CMRR and Slew rate.
2. Designing of an amplifier of given gain for an inverting and non-inverting configuration using an op-amp.
3. Designing of analog adder and subtractor circuit.
4. Designing of an integrator using op-amp for a given specification and study its frequency response.
5. Designing of a differentiator using op-amp for a given specification and study its frequency response.
6. Designing of a First Order Low-pass filter using op-amp.
7. Designing of a First Order High-pass filter using op-amp.
8. Designing of a RC Phase Shift Oscillator using op-amp.
9. Study of IC 555 as an astable multivibrator.
10. Study of IC 555 as monostable multivibrator.
11. Designing of Fixed voltage power supply using IC regulators using 78 series and 79 series

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Semester-IV

COURSE TITLE: SIGNALS & SYSTEMS

Course code: ELTC-402 **Course No:C-09**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:

Signals constitute an essential part of our everyday life. This course contains a basic introduction to signals and systems, introduction to its mathematical and graphical representations, LTI systems and discovering Laplace and Fourier transform methods for analyzing LTI systems. It also includes understanding and generation of signals by using mathematical simulation software tools like Matlab/SciLab.

Unit-1 (17 Lectures, 15 Marks)

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

Unit-2 (13 Lectures, 10 Marks)

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

Unit-3 (18 Lectures, 15 Marks)

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.

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

Unit-4 (12 Lectures, 10 Marks)

Laplace Transform: Laplace Transform, Inverse Laplace Transform, Properties of the Laplace Transform, Laplace Transform Pairs, Laplace Transform for signals, Laplace Transform of derivative and integral, Laplace Transform Methods in Circuit Analysis, Impulse and Step response of RL, RC and RLC circuits.

Suggested Books:

1. 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. C. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)
4. H. P. Hsu, 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)
7. M. Roberts, Fundamentals of Signals and Systems, Tata McGraw Hill (2007)

Practicals: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Signals & Systems Lab (Scilab/MATLAB/ Other Mathematical Simulation software)

60 Periods

1. Generation of Signals: continuous time
2. Generation of Signals: discrete time
3. Time shifting and time scaling of signals.
4. Convolution of Signals
5. Solution of Difference equations.
6. Fourier series representation of continuous time signals.
7. Fourier transform of continuous time signals.
8. Laplace transform of continuous time signals.
9. Introduction to Xcos/similar function and calculation of output of systems represented by block diagrams

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Semester-IV

COURSE TITLE: ELECTRONIC INSTRUMENTATION

Course code: ELTC-403 **Course No:C-10**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 End Semester: 50 In Semester: 15

Course Objectives:

Electronic Instrumentation paper assists students to recognize the configurations and functional explanation of measuring instruments, their basic performance, working principles, and characteristics. The course includes oscilloscopes, signal generators, Sensors, Transducers and various instruments of electronics for multidisciplinary fields.

Unit-1 (15 Lectures, 12 Marks)

Qualities of Measurement: Specifications of instruments, their static and dynamic characteristics, Error (Gross error, systematic error, absolute error and relative error) and uncertainty analysis. Basic idea of statistical analysis of data.

Basic Measurement Instruments: PMMC instrument, galvanometer, DC measurement - ammeter, voltmeter, **o**hm meter, AC measurement, Digital voltmeter (integrating and non-integrating types), digital multimeters, digital frequency meter (different modes and universal counter).

Connectors and Probes: Low capacitive probes, high voltage probes, current probes, identifying electronic connectors – audio and video, RF/Coaxial, USB etc.

Unit-2 (15 Lectures, 12 Marks)

Measurement of Resistance and Impedance: Low Resistance: Kelvin's double bridge method, Medium Resistance by Voltmeter Ammeter method, Wheatstone bridge method, High Resistance by Megger. A.C. bridges, Measurement of Self Inductance and Anderson's bridge, Measurement of Capacitance, Schering's bridge, DeSauty's bridge, Measurement of frequency, Wien's bridge.

A-D and D-A Conversion: 4 bit binary weighted resistor type D-A conversion, circuit and working. Circuit of R-2R ladder. A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs for all).

Unit-3 (16 Lectures, 14 Marks)

Oscilloscopes: CRT, wave form display and electrostatic focusing, time base and sweep synchronization, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Dual trace oscilloscope, Sampling Oscilloscope.

DSO and DPO: Basic idea, working principle, Advantages and applications, CRO (bandwidth, sensitivity, rise time etc).

Signal Generators: Audio oscillator, Pulse Generator, Function generators.

Unit-4 (14 Lectures, 12 Marks)

Transducers and sensors: Basic idea and characteristics of transducers, active & passive transducers, Resistive, Capacitive, Inductive (LVDT) and piezoelectric transducers.
Measurement of displacement, velocity and acceleration. Measurement of pressure, Measurement of temperature, Light transducers.

Suggested Books:

1. H. S. Kalsi, Electronic Instrumentaion, TMH(2006)
2. W.D. Cooper and A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice-Hall (2005).
3. Instrumentation Measurement and analysis: Nakra B C, Chaudry K, TMH
4. E.O.Doebelin, Measurement Systems: Application and Design, McGraw Hill Book - fifth Edition (2003).
5. Joseph J Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education (2005)
6. David A. Bell, Electronic Instrumentation and Measurements, Prentice Hall (2013).
7. Oliver and Cage, "Electronic Measurements and Instrumentation", TMH (2009).
8. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Buterworth Heinmann-2008).
9. A. K Sawhney, Electrical and Electronics Measurements and Instrumentation, DhanpatRai and Sons (2007).
10. C. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata Mcgraw Hill (1998).

Practicals: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Electronic Instrumentation Lab

60 Periods

1. Design of multi range ammeter and voltmeter using galvanometer.
2. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity.
3. Measurement of Capacitance by de'Sautys.
4. Measure of low resistance by Kelvin's double bridge.
5. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement of Strain using half and full bridge.)
6. To determine the Characteristics of LVDT.
7. To determine the Characteristics of Thermistors and RTD.
8. Measurement of temperature by Thermocouples and study of transducers like AD590 (two terminal temperature sensor), PT-100, J- type, K-type.
9. To study the Characteristics of LDR, Photodiode, and Phototransistor:
   (i) Variable Illumination.
   (ii) Linear Displacement.
10. Characteristics of one Solid State sensor/ Fiber optic sensor

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Semester-V
COURSE TITLE: MICROPROCESSOR AND MICROCONTROLLERS
Course code: ELTC-501 **Course No:C-11**
Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:
The purpose of this course is to teach students the fundamentals of microprocessor and microcontroller systems. The student will be able to incorporate these concepts into their electronic designs where control can be achieved via a microprocessor/controller implementation. Topics include on a simple microprocessor, 8085, 8051, PIC Semiconductor memory devices and systems, microcomputer architecture, assembly language programming, I/O programming, I/O interface design, I/O peripheral devices, data communications, and data acquisition systems. Several laboratory exercises will be based on both microprocessor (Intel 8086) and microcontroller (PIC/Intel 8051).

Unit-1 (18 Lectures, 15 Marks)
Introduction to Microprocessor: Introduction, Applications, Basic block diagram, Speed, Word size, Memory capacity, Classification of microprocessors (mention of different microprocessors being used)
Microprocessor 8085: Features, Architecture -block diagram, General purpose registers, register pairs, flags, stack pointer, program counter, types of buses. Multiplexed address and data bus, generation of control signals, pin description of microprocessor 8085. Basic interfacing concepts, Memory mapped I/O and I/O mapped I/O.
8085 Instructions: Operation code, Operand & Mnemonics. Instruction set of 8085, instruction classification, addressing modes, instruction format. Data transfer instructions, arithmetic instructions, increment & decrement instructions, logical instructions, branch instructions and machine control instructions. Assembly language programming examples.

Unit-2 (10 Lectures, 10 Marks)
Stack operations, subroutine, call and return instructions. Delay loops, use of counters, timing diagrams-instruction cycle, machine cycle, T- states, time delay.
Interrupt structure of 8085A microprocessor, processing of vectored and non-vectored interrupts, latency time and response time; Handling multiple interrupts
Microcontrollers: Introduction, different types of microcontrollers, embedded microcontrollers, processor architectures. Harvard, Princeton and Von Neumann, CISC vs. RISC architectures, microcontroller memory types, microcontroller features, clocking, I/O pins, interrupts, timers, peripherals, 8051 family microcontroller.

Unit-3 (18 Lectures, 15 Marks)

PIC16F887 Microcontroller: Core features, Architecture, pin diagram, memory organization- Program and data memory organization, I/O Ports, oscillator module, Timer modules (Timer 0, Timer 1 and Timer 2), comparator module, analog-to-digital converter (ADC) module, data EEPROM, Enhanced capture/compare/PWM module , EUSART, master synchronous serial port (MSSP) module, special features of the CPU, interrupts, addressing modes, instruction set.

Unit-4 (14 Lectures, 10Marks)

Interfacing to PIC16F887: LED, Switches, Solid State Relay, Seven Segment Display, 16x2 LCD display, 4x4Matrix Keyboard, Digital to Analog Converter, Stepper Motor and DC Motor. Interfacing program examples using C language.

Suggested Books:

1. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S.Gaonkar - Wiley Eastern Limited- IV Edition.
2. Fundamentals of Microprocessor & Microcomputer: B. Ram—Danpat Rai Publications.
3. Microchip PIC16F87X datasheet
4. PIC Microcontrollers, Milan Verle, , mikro Elektronika, 1st edition (2008)
5. Muhammad Ali Mazidi, "Microprocessors and Microcontrollers", Pearson, 2006

Practicals: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Microprocessor and Microcontrollers Lab

60 Periods

8085 Assembly language programs:

1. Program to transfer a block of data.
2. Program for multibyte addition
3. Program for multibyte subtraction
4. Program to multiply two 8-bit numbers.
5. Program to divide a 16 bit number by 8 bit number.
6. Program to search a given number in a given list.
7. Program to generate terms of Fibonacci series.
8. Program to find minimum and maximum among N numbers
9. Program to find the square root of an integer.
10. Program to find GCD of two numbers.
11. Program to sort numbers in ascending/descending order.
12. Program to verify the truth table of logic gates.

PIC/8051 Microcontroller Programming

Note: Programs to be written using C programming language

1. LED blinking with a delay of 1 second.
2. Solid State Relay Interface
3. Interfacing of LCD (2X16).

4. Interfacing of stepper motor and Rotating stepper motor by N steps clockwise/anticlockwise with speed control.
5. To test all the gates of a given IC74XX is good or bad.
6. Generate sine, square, saw tooth, triangular and staircase waveform using DAC interface.
7. Display of 4- digit decimal number using the multiplexed 7-segment display interface.
8. Analog to digital conversion using internal ADC and display the result on LCD.
9. Implementation of DC-Volt meter (0-5V) using internal ADC and LCD
10. Digital to analog conversion using PWM (pulse delay to be implemented using timers).
11. Speed control of DC motor using PWM (pulse delay to be implemented using timers).
12. Interfacing of matrix keyboard (4X4).
13. Serial communication between microcontroller and PC.

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Semester-V

COURSE TITLE: ELECTROMAGNETICS

Course code: ELTC-502 **Course No: C-12**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 End Semester: 50 In Semester: 15

Course Objectives:

The goal is to introduce basic electromagnetics and establish the fundamentals of devices in electromagnetic applications, as required by engineers in energy systems, telecommunications, computing and other technologies. Student will become familiar with electromagnetic applications such as capacitors, inductors, transformers, transmission lines, Smith charts, impendence matching circuits, waveguides and antennas, that are used in the designs and implementations of electrical power systems and modern wireless communications systems. Laboratories are used to reinforce the course material using computer software.

Unit-1 (16 Lectures, 15 Marks)

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, Field due to Discrete and Continuous Charge Distributions, Electric Flux Density, Gauss's Law and Applications, Divergence Theorem and Maxwell's First Equation. Electric Potential, Potential due to a Charge and Charge distribution, Electric dipole. Electric Fields in Conductors, Current and Current Density, Continuity of Current, Metallic Conductor Properties and Boundary Conditions, Method of Images. Dielectric materials, Polarization, Dielectric Constant, Isotropic and Anisotropic dielectrics, Boundary conditions, Capacitance and Capacitors. Electrostatic Energy and Forces.

Unit- 2 (14 Lectures, 12 Marks)

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. **Magnetostatics:** Biot Savert's law and Applications, Magnetic dipole, Ampere's Circuital Law, Curl and Stoke's Theorem, Maxwell's Equation, Magnetic Flux and Magnetic Flux Density, Scalar and Vector Magnetic Potentials. Magnetization in Materials and Permeability, Anisotropic materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy, Magnetic Circuits. Inductances and Inductors, Magnetic Energy, Forces and Torques.

Unit-3 (13 Lectures, 10 Marks)

Time-Varying Fields and Maxwell's Equations: Faraday's Law of Electromagnetic Induction, Stationary Circuit in Time-Varying Magnetic Field, Transformer and Motional EMF,

Displacement Current, Maxwell's Equations in differential and integral form and Constitutive Relations. Potential Functions, Lorentz gauge and the Wave Equation for Potentials, Concept of Retarded Potentials. Electromagnetic Boundary Conditions. Time-Harmonic Electromagnetic Fields and use of Phasors

Unit-4 (17 Lectures, 13 Marks)

Electromagnetic Wave Propagation: Time- Harmonic Electromagnetic Fields and use of Phasors, the Electromagnetic Spectrum, Wave Equation in a source free isotropic homogeneous media, Uniform Plane Waves in Lossless and Lossy unbounded homogeneous media, Wave Polarization, Phase and Group velocity, Flow of Electromagnetic Power and Poynting Vector. Uniform Plane wave incident on a Plane conductor boundary, concept of reflection and standing wave.

Guided Electromagnetic Wave Propagation: Introduction to waveguide, types of waveguides, Waves along Uniform Guiding Structures, TEM, TE and TM waves, Electromagnetic Wave Propagation in Parallel Plate and Rectangular Metallic Waveguides.

Suggested Books:

1. Murray. R. Spiegel, Vector Analysis, Schaum series, Tata McGraw Hill (2006)
2. M. N. O. Sadiku, Elements of Electromagnetics, Oxford University Press (2001)
3. W. H. Hayt and J. A. Buck, Engineering Electromagnetics, Tata McGraw Hill (2006)
4. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education (2001)
5. J. A. Edminster, Electromagnetics, Schaum Series, Tata McGraw Hill (2006)
6. N. Narayan Rao, Elements of Engineering Electromagnetics, Pearson Education (2006)
7. Introduction to Electrodynamics, D.J. Griffiths, Pearson Education (2012)
8. Electromagnetic Wave and Radiating System, Jordan and Balmain, Prentice Hall (1979)
9. B. B. Laud, Electromagnetics, New Age International Publishers (2015)

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Electromagnetics Lab (using Scilab/Matlab any other similar freeware)

60 Periods

1. Understanding and Plotting Vectors.
2. Transformation of vectors into various coordinate systems.
3. 2D and 3D Graphical plotting with change of view and rotation.
4. Representation of the Gradient of a scalar field, Divergence and Curl of Vector Fields.
5. Plots of Electric field and Electric Potential due to charge distributions.
6. Plots of Magnetic Flux Density due to current carrying wire.
7. Programs and Contour Plots to illustrate Method of Images
8. Solutions of Poisson and Laplace Equations – contour plots of charge and potential distributions
9. Introduction to Computational Electromagnetics: Simple Boundary Value Problems by Finite Difference/Finite Element Methods.

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Semester-VI

COURSE TITLE: COMMUNICATION ELECTRONICS

Course code: ELTC-601 **Course No: C-13**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 End Semester: 50 In Semester: 15

Course Objectives:

Communication Electronics paper assists students to recognize the concepts associated with the wireless transmission and reception of analog modulated signals. It provides adequate background in introducing fundamental principles of electronic communication system, AM, FM, and PM modulation, Digital Carrier Modulation Techniques, and frequency shifting and mixing.

Unit-1 (10 Lectures, 10 Marks)

Electronic communication: Block diagram of an electronic communication system, electromagnetic spectrum-band designations and applications, need for modulation, concept of channels and base-band signals. Concept of Noise, Types of Noise, Signal to noise ratio, Noise Figure, Noise Temperature, Friss formula.

Unit-2 (20 Lectures, 15 Marks)

Amplitude Modulation: Amplitude Modulation, modulation index and frequencyspectrum. Generation of AM, Amplitude Demodulation (diode detector), Concept of Double side band suppressed carrier, Single side band suppressed carrier, other forms of AM (Pilot Carrier Modulation, Vestigial Side Band modulation, Independent Side Band Modulation). Block diagram of AM Transmitter and Receiver.

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 (PLL). Block diagram of FM Transmitter and Receiver Comparison between AM, FM and PM.

Unit -3 (14 Lectures, 12 Marks)

Pulse Analog Modulation: Channel capacity, Sampling theorem, PAM, PDM, PPM modulation and detection techniques, Multiplexing, TDM and FDM.

Pulse Code Modulation: Need for digital transmission, Quantizing, Uniform and Non-uniform Quantization, Quantization Noise, Companding, Coding, Decoding, Regeneration.

Unit -4 (16 Lectures, 13 Marks)

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).

Suggested Books:

1. Electronic communication systems- Kennedy, 3rd edition, McGraw international publications
2. Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill
3. Communication Systems, S. Haykin, Wiley India (2006)
4. Advanced electronic communications systems – Tomasi, 6th edition, PHI.
5. Communication Systems, S. Haykin, Wiley India (2006)

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Communication Electronics Lab (Hardware and Circuit Simulation Software)

60 Periods

1. Study of Amplitude Modulation
2. Study of Amplitude Demodulation
3. Study of Frequency Modulation
4. Study of Frequency Demodulation
5. Study of Pulse Amplitude Modulation
6. AM Transmitter/Receiver
7. FM Transmitter/Receiver
8. Study of TDM, FDM
9. Study of Pulse Width Modulation
10. Study of Pulse Position Modulation
11. Study of Pulse Code Modulation
12. Study of Amplitude Shift Keying
13. Study of Phase Shift Keying,
14. Study of Frequency Shift Keying.

Detailed Syllabus for Core Course
B.Sc. (Honours) Electronic Science

Semester-VI

COURSE TITLE: PHOTONICS

Course code: ELTC-602 **Course No: C-14**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 End Semester: 50 In Semester: 15

Course Objectives:

Photonics is the science of generating, controlling, and detecting light in the UV, visible, and near IR spectrum. This course provides students with the strong foundation in optics discussing depth functioning knowledge of optical physics, including diffraction and Interference, Polarization and optical spectroscopy. And the course further discussed the various science of photonics investigating emission, transmission, amplification, detection, and modulation of light covering few topics like Laser, LEDs, Photodetector, LCD, Guided Waves and the Optical Fiber.

Unit-1 (22 Lectures, 16 Marks)

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, Interference by division of wavefront, Young's double slit, Division of Amplitude, thin film interference, anti-reflecting films, Newton's rings; Michelson interferometer. Holography. **Diffraction:** Huygen Fresnel Principle, Diffraction Integral, Fresnel and Fraunhoffer approximations. Fraunhoffer Diffraction by a single slit, rectangular aperture, double slit, Resolving power of microscopes and telescopes; Diffraction grating: Resolving power and Dispersive power

Unit-2 (13 Lectures, 12 Marks)

Polarization: Linear, circular and elliptical polarization, polarizer-analyzer and Malus' law; Double refraction by crystals, Interference of polarized light, Wave propagation in uniaxial media. Half wave and quarter wave plates. Faraday rotation and electro-optic effect.

Unit-3 (13 Lectures, 12 Marks)

Light Emitting Diodes: Construction, materials and operation.

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.

Photodetectors: Bolometer, Photomultiplier tube, Charge Coupled Device. Photo transistors and Photodiodes (p-i-n, avalanche), quantum efficiency and responsivity.

LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays.

Unit-4 (12 Lectures, 10 Marks)

Guided Waves and the Optical Fiber: TE and TM modes in symmetric slab waveguides, effective index, field distributions, Dispersion relation and Group Velocity. Step index optical fiber, total internal reflection, concept of linearly polarized waves in the step index circular dielectric waveguides, single mode and multimode fibers, attenuation and dispersion in optical fiber.

Suggested Books:

1. Ajoy Ghatak, Optics, Tata McGraw Hill, New Delhi (2005)
2. E. Hecht, Optics, Pearson Education Ltd. (2002)
3. J. Wilson and J. F. B. Hawkes, Optoelectronics: An Introduction, Prentice Hall India(1996)
4. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Pearson Education (2009)
5. Ghatak A.K. and Thyagarajan K., "Introduction to fiber optics," Cambridge Univ. Press. (1998)

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Photonics Lab

60 Periods

1. To verify the law of Malus for plane polarized light.
2. To determine wavelength of sodium light using Michelson's Interferometer.
3. To determine wavelength of sodium light using Newton's Rings.
4. To determine the resolving power and Dispersive power of Diffraction Grating.
5. Diffraction experiments using a laser.
6. Study of Faraday rotation.
7. Study of Electro-optic Effect.
8. To determine the specific rotation of scan sugar using polarimeter.
9. To determine characteristics of LEDs and Photo- detector.
10. To measure the numerical aperture of an optical fiber.

Detailed Syllabus for Core Course-Discipline Specific Elective
B.Sc. (Honours) Electronic Science

Semester-V

COURSE TITLE: NUMERICAL ANALYSIS

Course code: ELTD-501 **Course No: DSE-01.A**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 End Semester: 50 In Semester: 15

Course Objectives:

To understand complex systems, physicists, engineers and mathematicians need computational methods to describe it in simple ways. The key objective of the course is to develop the basic understanding of numerical algorithms and abilities to implement algorithms to solve mathematical problems on the computer. This course offers numerical methods for solving mathematical problems. It deals with the theory and application of numerical approximation techniques as well as their computer implementation.

Unit-1 (16 Lectures, 13 Marks)

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, Rate of convergence, General Iteration Methods, Newton's Method for Systems, Method for Complex Roots , Roots of Polynomial Equations.

Unit-2 (14 Lectures, 12 Marks)

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 (16 Lectures, 13 Marks)

Numerical Integration: Trapezoidal Rule, Error bounds and estimate for the Trapezoidal rule, Simpson's Rule, Error of Simpson's rule.

Numerical Differentiation: Finite difference method and applications to electrostatic boundary value problems.

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 (14 Lectures, 12 Marks)

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. V. Rajaraman, Computer Oriented Numerical Methods, Prentice Hall India, Third Edition.
3. S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall India (2008).
4. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods: Problems and Solutions, New Age International (2007).
5. B.S. Grewal, Numerical Methods in Engineering and Science with Programs in C and C++, Khanna Publishers (2012).

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Numerical Techniques Lab (C language/ Scilab/MATLAB/Other Mathematical Simulation software)

60 Periods

1. Program to implement Bisection Method
2. Program to implement Secant Method
3. Program to implement Regula falsi method
4. Program to implement Newton Raphson Method
5. Program to implement Trapezoidal rule
6. Program to implement Simpson's rule
7. Program to implement Runge Kutta Method
8. Program to implement Euler-Cauchy Method
9. Program to implement Gauss-Jordon Method
10. Program to implement Gauss-Seidel Iteration

Detailed Syllabus for Core Course-Discipline Specific Elective
B.Sc. (Honours) Electronic Science

Semester-V
COURSE TITLE: COMPUTER NETWORKS
Course code: ELTD-502 **Course No: DSE-01.B**
Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 End Semester: 50 In Semester: 15

Course Objectives:
Upon completing the course, students will be able to familiarize with the basics of data communication, Switching, various types of computer networks. The course will explain in details how computer networks are organized with the concept of layered approach. This course also covers computer networks concepts, Network Layer, Data Link Layer Transport Layer, application layer protocols.

Unit- I (15 Lectures, 13 Marks)
Data Communications : Components, protocols and standards, Network and Protocol Architecture, Reference Model ISO-OSI, TCP/IP-Overview ,topology, transmission mode, digital signals, digital to digital encoding, digital data transmission, DTE-DCE interface, interface standards, modems, cable modem, transmission media- guided and unguided, transmission impairment, Performance, wavelength and Shannon capacity. Review of Error Detection and Correction codes.
Switching: Circuit switching (space-division, time division and space-time division), packet switching (virtual circuit and Datagram approach), message switching.

Unit-2 (15 Lectures, 12 Marks)
Data Link Layer: Design issues, Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Sliding window protocol, Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point-to –Point Access: PPP Point –to- Point Protocol, PPP Stack,
Medium Access Sub layer: Channel allocation problem, Controlled Access, Channelization, multiple access protocols, IEEE standard 802.3 & 802.11 for LANS and WLAN, high-speed LANs, Token ring, Token Bus, FDDI based LAN, Network Devices-repeaters, hubs, switches bridges.

Unit-3 (15 Lectures, 13 Marks)
Network Layer: Design issues, Routing algorithms, Congestion control algorithms,Host to Host Delivery: Internetworking, addressing and routing, IP addressing (class full & Classless), Subnet, Network Layer Protocols: ARP, IPV4, ICMP, IPV6, ICMPV6.

Unit- 4 (15 Lectures, 12 Marks)

Transport Layer: Process to Process Delivery: UDP; TCP, congestion control and Quality of service.

Application Layer: Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP), file transfer (FTP), HTTP and WWW.

Suggested Books:

1. S. Tannenbum, D. Wetherall, "Computer Networks", Prentice Hall, Pearson, 5th Ed
2. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, 4th Ed.

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Computer Networks Lab

60 Periods

1. Introduction to Computer Network laboratory Introduction to Discrete Event Simulation Discrete Event Simulation Tools - ns2/ns3, Omnet++.
2. Using Free Open Source Software tools for network simulation of telnet and ftp between N sources - N sinks (N = 1, 2, 3). Evaluate the effect of increasing data rate on congestion.
3. Using Free Open Source Software tools for network simulation to study the effect of queuing disciplines on network performance - Random Early Detection/Weighted RED / Adaptive RED.
4. Using Free Open Source Software tools for network simulation for http, ftp and DBMS access in networks.
5. Using Free Open Source Software tools for network simulation to study effect of VLAN on network performance - multiple VLANs and single router.
6. Using Free Open Source Software tools for network simulation to study effect of VLAN on network performance - multiple VLANs with separate multiple routers.
7. Using Free Open Source Software tools for network simulation to study the performance of wireless networks.

Detailed Syllabus for Core Course-Discipline Specific Elective
B.Sc. (Honours) Electronic Science

Semester-V
COURSE TITLE: POWER ELECTRONICS
Course code: ELTD-503 **Course No: DSE-02.A**
Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:
The contents of Power Electronics paper help students to pinpoint the theory and operation of power semiconductor devices, uncontrolled/controlled rectifiers, ac voltage controllers, switching characteristics of devices, Diac and Triac, *Power MOSFETs, Power Inverters, choppers, Electromechanical Machines.*

Unit- 1 (12 Lectures, 10 Marks)
Power Devices: Need for semiconductor power devices, Power diodes, Enhancement of reverse blocking capacity, Introduction to family of thyristors.
Silicon Controlled Rectifier (SCR): structure, I-V characteristics, Turn-On and Turn-Off characteristics, ratings, Factors affecting the characteristics/ratings of SCR, Gate-triggering circuits, Control circuits design and Protection circuits, Snubber circuit.

Unit- 2 (14 Lectures, 10 Marks)
Diac and Triac: Basic structure, working and V-I characteristic of Diac and Triac, application of a Diac as a triggering device for a Triac.
Insulated Gate Bipolar Transistors (IGBT): Basic structure, I-V Characteristics, switching characteristics, device limitations and safe operating area (SOA) etc.
Application of SCR: SCR as a static switch, phase controlled rectification, single phase half wave, full wave and bridge rectifiers with inductive & non-inductive loads; AC voltage control using SCR and Triac as a switch.
Power MOSFETs: operation modes, switching characteristics, power BJT, second breakdown, saturation and quasi-saturation state.

Unit- 3 (17 Lectures, 15 Marks)
Power Inverters: Need for commutating circuits and their various types, d.c. link invertors, Parallel capacitor commutated invertors with and without reactive feedback and its analysis, Series Invertor, limitations and its improved versions, bridge invertors.
Choppers: basic chopper circuit, types of choppers(Type A-D), step-down chopper, step-up chopper, operation of d.c. chopper circuits using self-commutation (A & B- type commutating circuit), cathode pulse turn-off chopper(using class D commutation), load sensitive cathode pulse turn-off chopper (Jones Chopper), Morgan's chopper

Unit- 4 (17 Lectures, 15 marks)

Electromechanical Machines: DC Motors, Basic understanding of field and armature, Principle of operation, EMF equation, Back EMF, Factors controlling motor speed, Thyristor based speed control of dc motors, AC motor (Induction Motor only), Rotor and stator, torque & speed of induction motor, Thyristor control of ac motors (block diagrams only).

Suggested Books:

1. Power Electronics, P.C. Sen, TMH
2. Power Electronics & Controls, S.K. Dutta
3. Power Electronics, M.D. Singh & K.B. Khanchandani, TMH
4. Power Electronics Circuits, Devices and Applications, 3rd Edition, M.H. Rashid, Pearson Education
5. Power Electronics, Applications and Design, Ned Mohan, Tore.
6. Power Electronics, K. HariBabu, Scitech Publication.
7. Power Electronics, M.S. Jamil Asghar, PHI.
8. A Textbook of Electrical Technology-Vol-II, B.L. Thareja, A.K. Thareja, S.Chand

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Power Electronics Lab

60 Periods

1. Study of I-V characteristics of DIAC
2. Study of I-V characteristics of a TRIAC
3. Study of I-V characteristics of a SCR
4. SCR as a half wave and full wave rectifiers with R and RL loads
5. DC motor control using SCR.
6. DC motor control using TRIAC.
7. AC voltage controller using TRIAC with UJT triggering.
8. Study of parallel and bridge inverter.
9. Design of snubber circuit
10. VI Characteristic of MOSFET and IGBT (Both)
11. Study of chopper circuits

Detailed Syllabus for Core Course-Discipline Specific Elective
B.Sc. (Honours) Electronic Science

Semester-VI

COURSE TITLE: DIGITAL SIGNAL PROCESSING

Course code: ELTD-504 **Course No: DSE-02.B**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 **End Semester: 50** **In Semester: 15**

Course Objectives:

This course provides an introduction to handling of discrete-time (DT) systems. The course specially designed to understand fundamental principles of DT systems and signals, in both time and Fourier domains, examining time and frequency domain techniques for designing and applying infinite impulse response (IIR) and finite impulse response (FIR) digital filters. During the course, the effort is on developing techniques and algorithms for solving discrete-time signal processing problems.

Unit- 1 (15 Lectures, 12 Marks)

Discrete Time systems: Discrete sequences, linear coefficient difference equation, Representation of DTS, LSI Systems. Stability and causality, frequency domain representations and Fourier transform of DT sequences.

Unit- 2 (15 Lectures, 12 Marks)

Z-Transform: Definition and properties, Inverse Z Transform and stability. Parsevals Theorem and applications.

System Function: signal flow graph, its use in representation and analysis of Discrete Time Systems. Techniques of representations. Matrix generation and solution for DTS evaluations.

Unit- 3 (15 Lectures, 13 Marks)

Discrete Fourier Transform: DFT assumptions and Inverse DFT. Matrix relations, relationship with FT and its inverse, circular convolution, DFT theorems, DCT. Computation of DFT. FFT Algorithms and processing gain, Discrimination, interpolation and extrapolation. Gibbs phenomena. FFT of real functions interleaving and resolution improvement. Word length effects.

Unit- 4 (15 Lectures, 12 Marks)

Digital Filters: Analog filter review. System function for IIR and FIR filters, network representation. Canonical and decomposition networks. IIR filter realization methods and their limitations. FIR filter realization techniques. Discrete correlation and convolution; Properties and limitations.

Suggested Books:

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
2. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall, 1997.

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Digital Signal Processing Lab (Scilab/MATLAB/Other Mathematical Simulation software)

60 Periods

1. Generation of unit sample sequence, unit step, ramp function, discrete time sequence, real sinusoidal sequence.
2. Generate and plot sequences over an interval.
3. Given x[n], write program to find X[z].
4. Fourier Transform, Discrete Fourier Transform and Fast Fourier Transform
5. Design of a Butterworth analog filter for low pass and high pass.
6. Design of digital filters.

Detailed Syllabus for Core Course-Discipline Specific Elective
B.Sc. (Honours) Electronic Science

Semester-VI
COURSE TITLE: SEMICONDUCTOR FABRICATION AND CHARACTERIZATION
Course code: ELTD-601 **Course No: DSE-03.A**
Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 End Semester: 50 In Semester: 15

Course Objectives:
Semiconductor Fabrication and Characterization paper assists students to recognize the various semiconductor process technology, fabrication methods and different measuring instruments to study their electrical, structural and optical characteristics. Further the course specially designed to give a depth view on Lithographic Processes, etching and metallization.

Unit- 1 (19 Lectures, 15 Marks)
Introduction of Semiconductor Process Technology (Line width – 10 nm technology), Semiconductor materials, single crystal, polycrystalline and amorphous, Crystal growth techniques: Si from the Czochralski technique, starting material, Distribution of dopants, Effective Segregation Coefficient. Silicon Float Zone Process, GaAs from Brigdman techniques. Wafer preparation.
Epitaxy Deposition: Epitaxial growth by vapor phase epitaxy (VPE) and molecular beam epitaxy (MBE).
Characterization: Various characterization methods for structural, electrical and optical properties. Basic idea of X-ray diffractometer, Scanning electron microscope, Transmission electron microscope and UV-VIS-NIR spectrophotometer.

Unit-2 (15 Lectures, 13 marks)
Oxidation: Thermal Oxidation Process: Kinetics of Growth for thick and thin Oxide, Dry and Wet oxidation. Effects of high pressure and impurities, Impurity Redistribution during Oxidation, Masking property of Silicon Oxide, Oxide Quality. Chemical vapour deposition of silicon oxide, properties of silicon oxide, step coverage, P-glass flow.
Diffusion: Basic Diffusion Process: Diffusion Equation, Diffusion Profiles. Extrinsic Diffusion Concentration Dependent Diffusivity. Lateral Diffusion. Doping through Ion Implantation and its comparison with diffusion.

Unit-3 (15 Lectures, 12 Marks)
Lithographic Processes: Clean room, Optical lithography, exposure tools, masks, Photoresist, Pattern Transfer, Resolution Enhancement Technique. Electron Beam Lithography, X-ray Lithography and Ion Beam Lithography. Comparison between various lithographic techniques.
Etching: Wet Chemical Etching-basic process and few examples of etchants for semiconductors, insulators and conductors; Dry etching using plasma etching technique.; **Metallization:** Uses of Physical Vapor Deposition and Chemical Vapor Deposition technique for Aluminum and Copper Metallization.

Unit-4 (11 Lectures, 10 Marks)

Process Integration: Passive components- Integrated Circuit Resistor, Integrated Circuit Inductor, Integrated Circuit Capacitor. Bipolar Technology: Basic fabrication process, Isolation techniques. MOSFET Technology: Basic fabrication process of NMOS, PMOS and CMOS technology.

Suggested Books:

1. Gary S.May and S.M.Sze , Fundamentals of Semiconductor Fabrication, John Wiley& Sons(2004)
2. Ludmila Eckertova, Physics of Thin films, 2nd Edition, Plenum Press (1986).

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Semiconductor Fabrication and Characterization Lab

60 Periods

1. To measure the resistivity of semiconductor crystal with temperature by four -probe method.
2. To determine the type (n or p) and mobility of semiconductor material using Hall-effect.
3. Oxidation process Simulation
4. Diffusion Process Simulation
5. To design a pattern using photolithographic process and its simulation
6. Process integration simulation
7. Fabrication of thin film using Spin Coating/Thermal Coating System.
8. Determination of Optical Bandgap through transmission spectra.

Detailed Syllabus for Core Course-Discipline Specific Elective
B.Sc. (Honours) Electronic Science

Semester-VI
COURSE TITLE: NANOELECTRONICS
Course code: ELTD-602 **Course No: DSE-03.B**
Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 End Semester: 50 In Semester: 15

Course Objectives:
The Nanoelectronics paper is to impart the basic concept of science behind the nano level electronics. Nanoscience is the study of structures and materials on the scale of nanometers. The course deeply discusses the growth techniques of nanomaterials, its Methods of Measuring Properties and Characterization techniques, applications.

Unit -1 (15 Lectures, 12 Marks)
Introduction: Definition of Nano-Science and Nano Technology, Applications of Nano-Technology.
Introduction to Physics of Solid State: Size dependence of properties, bonding in atoms and giant molecular solids, Electronic conduction, Systems confined to one, two or three dimension and their effect on property
Quantum Theory for Nano Science: Time dependent and time independent Schrodinger wave equations. Particle in a box, Potential step: Reflection and tunneling (Quantum leak). Penetration of Barrier, Electron trapped in 2D plane (Nano sheet), Quantum confinement effect in nano materials.
Quantum Wells, Wires and Dots: Preparation of Quantum Nanostructure; Size and Dimensionality effect, Fermi gas; Potential wells; Partial confinement; Excitons; Single electron Tunneling, Infrared detectors; Quantum dot laser Superconductivity.

Unit-2 (17 Lectures, 13 Marks)
Growth Techniques of Nanomaterials: Synthetic aspects: bottom up and top down approaches, Lithograpahic and Nonlithograpahic techniques, Sputtering and film deposition in glow discharge, DC sputtering technique (p-CuAlO2 deposition). Thermal evaporation technique, E-beam evaporation, Chemical Vapour deposition(CVD), Synthesis of carbon nano-fibres and multi-walled carbon nanotubes, Pulsed Laser Deposition, Molecular beam Epitaxy, Sol-Gel Technique (No chemistry required), Synthesis of nanowires/rods, Electro deposition, Chemical bath deposition, Ion beam deposition system, Vapor-Liquid –Solid (VLS) method of nanowire.

Unit -3 (18 Lectures, 15 marks)
Methods of Measuring Properties and Characterization techniques:
Microscopy: Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) including energy dispersive X-ray (EDX) analysis, low energy electron diffraction (LEED), reflection high energy electron diffraction (RHEED)

Spectroscopy: Infra-red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy
Characterization and application like biopolymer tagging and light emitting semiconductor quantum dots.

Unit- 4 (10 Lectures, 10 Marks)

Carbon nanotubes, nano cuboids, graphene, carbon quantum dots: Fabrication, structure. electrical, mechanical, and vibrational properties and applications. Use of nano particles for biological application, drug delivery and bio-imaging, Impact of nanotechnology on the environment.

Suggested Books:

1. Nanoscale Science and Technology, Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan, John Wiley & Sons, Ltd., UK, 2005.
2. Nanomaterials: synthesis, properties and applications, Institute of Physics, 1998.
3. Introduction to Nanotechnology, Charles P. Poole Jr and Frank J. Owens, Wiley Interscience, 2003.
4. Electron Microscopy and analysis, 2nd ed. Taylor and Francis, 2000.
5. Bio-Inspired Nanomaterials and Nanotechnology, Edited by Yong Zhou, Nova Publishers.
6. Quantum dot heterostructures, Wiley, 1999.
7. Modern magnetic materials: principles and applications, John Wiley & Sons, 2000.
8. Nano: The Essentials: Understanding Nanoscience and Nanotecnology, T.Pradeep, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.
9. Nanobiotechnology, concepts, applications and perspectives, Wiley-VCH, 2004.

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Nanoelectronics Lab

60 Periods

1. Synthesis of at least two different sizes of Nickel Oxide/ Copper Oxide/ Zinc Oxide Nano Particles Using Sol-Gel Method
2. Polymer synthesis by suspension method / emulsion method
3. B-H loop of nanomaterials.
4. Magnetoresistance of thin films and nanocomposite, I-V characteristics and transient response.
5. Particle size determination by X-ray diffraction (XRD) and XRD analysis of the given XRD spectra
6. Determination of the particle size of the given materials using He-Ne LASER.
7. Selective area electron diffraction: Software based structural analysis based on TEM based experimental data from published literature. (Note: Later experiment may be performed in the lab based on availability of TEM facility).
8. Surface area and pore volume measurements of nanoparticles (a standard sample and a new sample (if available)).
9. Spectroscopic characterization of metallic, semiconducting and insulating nanoparticles.

Detailed Syllabus for Core Course-Discipline Specific Elective
B.Sc. (Honours) Electronic Science

Semester-VI
COURSE TITLE: EMBEDDED SYSTEMS
Course code: ELTD-603 **Course No: DSE-04.A**
Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 End Semester: 50 In Semester: 15

Course Objectives:
The course will convey the basic concept of Embedded Systems, its features, Requirements and Applications. The course will include the Introduction to AVR RISC Microcontrollers, Simple programs in Assembly Language / C Language, Interrupts, Timer and Perpherals. In practically Microprocessors almost everywhere embedded together with sensors and actuators. The purpose of the course is to offer the basic information about embedded systems which can be defined as a control designed to perform a specific task.

Unit-1 (10 Lectures, 11 Marks)
Introduction to Embedded Systems: Overview of Embedded Systems, its features**,** Requirements and Applications, Recent Trends in the Embedded System Design, Common architectures for the Embedded System Design, Embedded Software design issues. Introduction to microcontrollers, Overview of Harvard architecture and Von Neumann architecture, RISC and CISC microcontrollers.

Unit –2 (17 Lectures, 13 Marks)
AVR RISC Microcontrollers: Introduction to AVR RISC Microcontrollers, Architecture overview, status register, general purpose register file, memories, Instruction set, Data Transfer Instructions, Arithmetic and Logic Instructions, Branch Instructions, Bit and Bit-test Instructions, MCU Control Instructions. Simple programs in Assembly Language / C Language.

Unit – 3 (17 Lectures, 13 Marks)
Interrupts and Timer: Introduction to System Clock, Reset sources, Introduction to interrupts, External interrupts, IO Ports, 8-bit and 16-bit Timers, introduction to different modes, Input Capture and Compare Match.

Unit – 4 (16 Lectures, 13 Marks)
Perpherals: Analog Comparator, Analog-to-Digital Converter, Serial Peripheral Interface (SPI), The Universal Synchronous and Asynchronous serial Receiver and Transmitter (USART), Two Wire Interface (TWI) / I^2C bus.

Suggested Books:

1. AVR Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, PHI

2. Embedded system Design - Frank Vahid and Tony Givargis, John Wiley, 2002
3. Programming and Customizing the AVR Microcontroller by D V Gadre, McGraw-Hill
4. Atmel AVR Microcontroller Primer: Programming and Interfacing by Steven F. Barrett, Daniel J. Pack, Morgan & Claypool Publishers
5. An Embedded Software Primer by David E Simon, Addison Wesley
6. AVR Microcontroller Datasheet, Atmel Corporation, www.atmel.com

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Embedded Systems Lab (Experiments to be performed on AVR trainer kit)

60 Periods

1. Flash LED at an observable rate.
2. Hello LED – Flash LED at a rate such that the LED appears always on. Estimate the onset of the rate when the LED appears to stay on
3. Controlling ON/OFF of an LED using switch.
4. Use LFSR based random number generator to generate a random number and display it.
5. Toggle the LED every second using Timer interrupt.
6. Use the potentiometer to change the red LED intensity from 0 to maximum in 256 steps.
7. Use the switch to select the LED (from RGB led) and then the potentiometer to set the
8. intensity of that LED and thus create your own color from amongst 16million colors.
9. Read the ADC value of the voltage divider involving the LDR. Print the value on the serial monitor.
10. Use the LDR and estimate a threshold for the LDR value and use that to turn the RGB LED on, to simulate an ‘automatic porch light’.
11. Use the thermistor to estimate the temperature and print the raw value on the serial monitor.
12. Connect the LCD I/O Board and print ‘Hello World’ on the LCD. Scroll display from left to right.
13. Use the on-board EEPROM to store the temperature min and max values together with a time stamp.
14. Speed control of d.c. motor.
15. Speed control of stepper motor.

Detailed Syllabus for Core Course-Discipline Specific Elective
B.Sc. (Honours) Electronic Science

Semester-VI

COURSE TITLE: BIOMEDICAL INSTRUMENTATION

Course code: ELTD-604 **Course No: DSE-04.B**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Theory Marks: 65 End Semester: 50 In Semester: 15

Course Objectives:

This course helps to develop an understanding of the measurement principles of medical instrumentation found in hospital or Clinical Diagnostic Laboratories. Understand the different diagnosis techniques including biochemical sensors, Physiological transducers, bioelectrical signals (ECG, EEG), measurement of respiratory function, cardiac variables, Audiometers, Humidifiers, Nebulizers Aspirators, Modern Imaging systems. It also provides Patients safety & Computer Applications in Biomedical field.

Unit 1 (17 Lectures, 13 Marks)

Biomedical signals & Physiological transducers: Source of biomedical signal, Origin of bioelectric signals, recording electrodes, Electrodes for ECG, EMG & EEG .Physiological transducers: Pressure, Temperature, photoelectric & ultrasound Transducers. Measurement in Respiratory system**:** Physiology of respiratory system, Measurement of breathing mechanics Spiro meter, Respiratory therapy equipments Inhalators ventilators & Respirators , Humidifiers , Nebulizers Aspirators, Biomedical recorders: ECG, EEG & EMG. MEMS based biosensors.

Unit -2 (16 Lectures, 13 Marks)

Patient Monitoring systems & Audiometers: Cardiac monitor, Bedside patient monitor, measurement of heart rate, blood pressure, temperature, respiration rate, Arrhythmia monitor, Methods of monitoring fatal heart rate, Monitoring labor activity. Audiometers: Audiometers, Blood cell counters, Oximeter, Blood flow meter, cardiac output measurement, Blood gas analyzers.

Unit- 3 (16 Lectures, 13 Marks)

Modern Imaging systems: Introduction, Basic principle & Block diagram of x-ray machine, x- ray Computed Tomography (CT), Magnetic resonance imaging system (NMR), ultrasonic imaging system. Eco-Cardiograph, Eco Encephalography, Ophthalmic scans, MRI. Therapeutic Equipments: Cardiac pacemakers, cardiac defibrillators, Hemodialysis machine, surgical diathermy machine.

Unit -4 (11 Lectures, 11 Marks)

Patients safety & Computer Applications in Biomedical field: Precaution, safety codes for electro medical equipment, Electric safety analyzer, Testing of biomedical equipment, Use of microprocessors in medical instruments, Microcontrollers, PC based medical instruments, Computerized Critical care units, Planning & designing a computerized critical care unit. **Physiotherapy:** Software Diathermy, microwave diathermy, Ultrasound therapy unit. Electrotherapy Equipments, Ventilators.

Suggested Books:

1. Joseph J. Carr & John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson.
2. Shakti Chatterjee, "Textbook of Biomedical Instrumentation System", Cengage Learning.
3. Khandpur R. S. - Handbook of Biomedical Instrumentation, TMH.
4. Bertil Jacobson & John G. Webster - Medicine and Clinical Engineering, PHI.
5. Prof.S.K.VenkataRam-Bio-Medical Electronics and Instrumentation, Galgotia Publications.
6. John G.Webster- Medical Instrumentation-Application and Design Wiley Student Edition).
7. L.Cromwell et al- Biomedical Instrumentation and Measurements PHI.

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Biomedical Instrumentation Lab

60 Periods

1. Characterization of bio potential amplifier for ECG signals.
2. Study on ECG simulator
3. Measurement of heart sound using electronic stethoscope. Study on ECG heart rate monitor /simulator
4. Study of pulse rate monitor with alarm system
5. Determination pulmonary function using spirometer (using mechanical system).
6. Measurement of respiration rate using thermister /other electrodes.
7. Study of Respiration Rate monitor/ apnea monitor
8. Study on ultrasound transducers based on medical system
9. Study of a Pacemaker.
10. Measurement of pulse rate using photoelectric transducer & pulse counting for known period.

Skill Based Course
B.Sc. (Honours) Electronic Science

Semester-III
COURSE TITLE: DESIGN AND FABRICATION OF PRINTED CIRCUIT BOARDS
Course code: ELTS-301 **Course No: SEC-01.A**
Credits: 02 **No. of Classes: 60**

Total Marks: 50 **End Semester: 40** **In Semester: 10**

Course Objectives:
This skill-based paper enhances student's understanding of PCB fundamentals, schematic and layout designing and Technologies. This course encourages students to develop a complete product of PCB with systematic process from designing and analyzing by circuit design simulation and then fabricating with required materials.

PCB Fundamentals: PCB Advantages, components of PCB, Electronic components, Microprocessors and Microcontrollers, IC's, Surface Mount Devices (SMD).
Classification of PCB - single, double, multilayer and flexible boards, Manufacturing of PCB, PCB standards.

Schematic & Layout Design: Schematic diagram, General, Mechanical and Electrical design considerations, Placing and Mounting of components, Conductor spacing, routing guidelines, heat sinks and package density, Net list, creating components for library, Tracks, Pads, Vias, power plane, grounding.

Technology OF PCB: Design automation, Design Rule Checking; Exporting Drill and Gerber Files; Drills; Footprints and Libraries Adding and Editing Pins, copper clad laminates materials of copper clad laminates, properties of laminates (electrical & physical), types of laminates, soldering techniques. Film master preparation, Image transfer, photo printing, Screen Printing, Plating techniques etching techniques, Mechanical Machining operations, Lead cutting and Soldering Techniques, Testing and quality controls.

PCB Technology: Trends, Environmental concerns in PCB industry.

Suggested Books:

1. Printed circuit Board – Design & Technology by Walter C. Bosshart, Tata McGraw Hill.
2. Printed Circuit Board –Design, Fabrication, Assembly & Testing, R.S. Khandpur, TATA McGraw Hill Publisher

Skill Based Course
B.Sc. (Honours) Electronic Science

Semester-III
COURSE TITLE: MOBILE APPLICATION PROGRAMMING
Course code: ELTS-302 **Course No: SEC-01.B**
Credits: 02 **No. of Classes: 60**

Total Marks: 50 **End Semester: 40** **In: 10**

Course Objectives:
Mobile Application Programming is a skill-based course assists students to recognize the configurations and working explanation of Mobile Application. This course will provide the introduction to Mobile Application Programming in different Android, iOS and Windows phone 8. Course put main emphasis on Android Development Environment, Android Software Development Platform, its Framework, Handling User Interface(UI) Events and Intents and Intent Filters etc.

Introduction: What is mobile Application Programming, Different Platforms, Architecture and working of Android, iOS and Windows phone 8operating system, Comparison of Android, iOS and Windows phone 8.

Android Development Environment: What is Android, Advantages and Future of Android, Tools and about Android SDK, Installing Java, Eclipse, and Android, Android Software Development Kit for Eclipse, Android Development Tool: Android Tools for Eclipse, AVDs: Smartphone Emulators, Image Editing,

Android Software Development Platform: Understanding Java SE and the Dalvik Virtual Machine, Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML, Screen Sizes, Launching Your Application: The AndroidManifest.xml File, Creating Your First Android Application.

Android Framework Overview: The Foundation of OOP, The APK File, Android Application Components, Android Activities: Defining the User Interface, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications, Content Providers: Data Management, Android Intent Objects: Messaging for Components, Android Manifest XML: Declaring Your Components.

Views and Layouts, Buttons, Menus, and Dialogs, Graphics Resources in Android:
Introducing the Drawables, Implementing Images, Core Drawable Subclasses, Using Bitmap, PNG, JPEG and GIF Images in Android, Creating Animation in Android

Handling User Interface(UI) Events: An Overview of UI Events in Android, Listening for and Handling Events , Handling UI Events via the View Class, Event Callback Methods, Handling Click Events, Touchscreen Events, Keyboard Events, Context Menus, Controlling the Focus.

Content Providers: An Overview of Android Content Providers, Defining a Content Provider, Working with a Database.
Intents and Intent Filters: Intent, Implicit Intents and Explicit Intents, Intents with Activities, Intents with Broadcast Receivers

Advanced Android: New Features in Android 4.4**.**

iOS Development Environment: Overview of iOS, iOS Layers, Introduction to iOS application development.

Windows phone Environment: Overview of windows phone and its platform, Building windows phone application.

Suggested Books:

1. Beginning Android 4, Onur Cinar , Apress Publication
2. Professional Android 4 Application Development, Reto Meier, Wrox
3. Beginning iOS 6 Development: Exploring the iOS SDK, David Mark, Apress
4. Beginning Windows 8 Application Development, István Novák, Zoltan Arvai, György Balássy and David Fulop.
5. Professional Windows 8 Programming: Application Development with C# and XML, Allen Sanders and Kevin Ashley, Wrox Publication.
6. Programming with Mobile Applications: Android, iOS, and Windows Phone 7 , Thomas Duffy, Course Technology, Cengage Learning 2013

Skill Based Course
B.Sc. (Honours) Electronic Science

Semester-IV
COURSE TITLE: INTERNET AND JAVA PROGRAMMING
Course code: ELTS-401 **Course No: SEC-02.A**
Credits: 02 **No. of Classes: 60**

Total Marks: 50 **End Semester : 40** **In Semester: 10**

Course Objectives:
Internet and Java programming is offered under skill-based course to give a basic concept on internet, different advanced features, explain the utility of Java programming language and its characteristics and its connection with internet.

Internet: Introduction, Understanding the Internet, Internet Addressing, Hardware Requirements to Connect to the Internet.

Data types, Arrays, Operators, Flow control: Branching, Looping. Classes, New Operator, Dot Operator, Method Declaration and Calling, Constructors, Inheritance, Super, Method Overriding Final, Finalize, Static, Package and Import Statement, Interface and Implements

Exception Handling: Exception Types, Uncaught and Calling, Nested Try Statements, Java Thread Model, and Thread, Runnable, Thread Priorities, Synchronization, Deadlock

File: Input Stream, Output Stream, and File Stream. Applets-Tag, Order of Applet Initialization, Repainting, Sizing Graphics- Abstract Window Tool Kit Components

Suggested Books:

1. Harley Hahn, The internet complete reference, Tata McGraw publicity,2nd Edition, 1997
2. Patrick Naughton, The Java hand book, Tata McGraw,1997

Skill Based Course
B.Sc. (Honours) Electronic Science

Semester-IV
COURSE TITLE: PROGRAMMING WITH LABVIEW
Course code: ELTS-402 **Course No: SEC-02.B**
Credits: 02 **No. of Classes: 60**

Total Marks: 50 **End Semester: 40** **In Semester: 10**

Course Objectives:
The Skilled based course ensures the programming with LabVIEW is a superior programming way to solve variety of problems. It provides the chance to explore the LabVIEW environment, dataflow programming, learn to develop data acquisition, and measurement analysis applications. Emphasis is on the practical aspects of interfacing a computer to various instruments including timing issues, real-time data acquisition and instrument control, instrument status, and acquisition speed.

Introduction to Virtual Instrumentation: Computers in Instrumentation, concept of Virtual Instrumentation (VI), History of VI, LabVIEW and VI, Conventional and Graphical Programming, Distributed Systems

Basics of LabVIEW: Components of LabVIEW, Owned and Free Labels, Tools and Other Palettes Arranging Objects, Pop-Up Menus ,Colour Coding, Code Debugging, Creating Sub-Vis, For Loop, While Loop, Loop Behaviour and Interloop Communication, Local Variables, Global Variables, Shift Registers, Feedback, Autoindexing, Loop Timing, Timed Loops Sequence Structures, Case Structure, Formula Node, Event Structure, Arrays, Clusters, Inter-Conversion of Arrays and Clusters, Waveform Chart, Resetting Plots, Waveform Graph, Use of Cursors, X-Y Graph, introduction to a State Machine, Event Structures, The Full State Machine, File Formats, File I/O Functions, Path Functions

Basics of Data Acquisition: Classification of Signals, Real-World Signals, Analog Interfacing, Connecting the Signal to the Board, Practical vs. Ideal Interfacing, Bridge Signal Sources.

Data Acquisition with LabVIEW: Measurement and Automation Explorer, Waveform Data Type, Working in DAQmx ,Working in NI-DAQ, Use of Simple analog and digital Vis, Continuous data acquisition, acquisition of data in bursts, DAQ Assistant, Analysis Assistant, Instrument Assistant, Instrument Interfacing and LabVIEW, Data Sockets.

Suggested Books:

1. Virtual Instrumentation using LabVIEW, II Edition, Sanjay Gupta, Joseph John, TMH Pvt. Ltd.
2. LabVIEW for Everyone, III Edition, J. Travis, J. King, Prentice Hall, 2006
3. LabVIEW Graphical Programming, IV Edition, G.W. Johnson, R. Jeninngs, Mcgraw Hill, 2006

Generic Electives
Sub: Electronic Science

Semester-I
COURSE TITLE: ELECTRONIC CIRCUITS AND PCB DESIGNING
Course code: ELTG-101 **Course No: GE-01**
Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Marks: 50 **End Semester: 40** **In Semester: 10**

Course Objectives:
This skill-based paper enhances student's understanding of PCB fundamentals, schematic and layout designing and Technologies. This course encourages students to develop a complete product of PCB with systematic process from designing and analyzing by circuit design simulation and then fabricating with required materials.

Unit-1 (12 Lectures, 10 Marks)
Network theorems (DC analysis only): Review of Ohms law, Kirchhoff's laws, voltage divider and current divider theorems, open and short circuits.
Thevenin's theorem, Norton's theorem and interconversion, superposition theorem, maximum power transfer theorem.

Unit 2 (13 Lectures, 10 Marks)
Semiconductor Diode and its applications: PN junction diode and characteristics, ideal diode and diode approximations. Block diagram of a Regulated Power Supply, Rectifiers: HWR, FWR - center tapped and bridge FWRs. Circuit diagrams, working and waveforms, ripple factor & efficiency(no derivations).Filters: circuit diagram and explanation of shunt capacitor filter with waveforms.
Zener diode regulator: circuit diagram and explanation for load and line regulation, disadvantages of Zener diode regulator.

Unit-3 (17 Lectures, 15 Marks)
BJT and Small Signal amplifier: Bipolar Junction Transistor: Construction, principle & working of NPN transistor, terminology. Configuration: CE, CB, CC. Definition of α, β and γ and their interrelations, leakage currents. Study of CE Characteristics, Hybrid parameters.
Transistor biasing: need for biasing, DC load line, operating point, thermal runaway, stability and stability factor.
Voltage divider bias: circuit diagrams and their working, Q point expressions for voltage divider biasing.
Small signal CE amplifier: circuit, working, frequency response, re model for CE configuration, derivation for Av, Zin and Zout.

Unit-4 (18 Lectures, 15 Marks)

Types of PCB: Single sided board, double sided, Multilayer boards, Plated through holes technology, Benefits of Surface Mount Technology (SMT), Limitation of SMT, Surface mount components: Resistors, Capacitor, Inductor, Diode and IC's.

Layout and Artwork: Layout Planning: General rules of Layout, Resistance, Capacitance and Inductance, Conductor Spacing, Supply and Ground Conductors, Component Placing and mounting, Cooling requirement and package density, Layout check.

Basic artwork approaches, Artwork taping guidelines, General artwork rules: Artwork check and Inspection.

Laminates and Photoprinting: Properties of laminates, Types of Laminates, Manual cleaning process, Basic printing process for double sided PCB's, Photo resists, wet film resists, Coating process for wet film resists, Exposure and further process for wet film resists, Dry film resists

Etching and Soldering: Introduction, Etching machine, Etchant system. Principles of Solder connection, Solder joints, Solder alloys, Soldering fluxes. Soldering, Desoldering tools and Techniques.

Suggested Books:

1. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky, 9th Edition, 2013, PHI
2. Electronics text lab manual, Paul B. Zbar.
3. Electric circuits, Joeseph Edminister, Schaum series.
4. Basic Electronics and Linear circuits, N.N. Bhargava, D.C. Kulshresta and D.C Gupta -TMH.
5. Electronic devices, David A Bell, Reston Publishing Company/DB Tarapurwala Publ.
6. Walter C.Bosshart "PCB DESIGN AND TECHNOLOGY" Tata McGraw Hill Publications, Delhi. 1983
7. Clyde F.Coombs "Printed circuits Handbook" III Edition, McGraw Hill.

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Electronic Circuits and PCB Designing Lab (Hardware and Circuit Simulation Software)

60 Periods

1. Verification of Thevenin's theorem
2. Verification of Super position theorem
3. Verification of Maximum power transfer theorem.
4. Half wave Rectifier – without and with shunt capacitance filter.
5. Centre tapped full wave rectifier – without and with shunt capacitance filter.
6. Zener diode as voltage regulator – load regulation.
7. Transistor characteristics in CE mode – determination of ri, ro and β.
8. Design and study of voltage divider biasing.

9. Designing of an CE based amplifier of given gain
10. Designing of PCB using artwork, its fabrication and testing.
11. Design, fabrication and testing of a 9 V power supply with zener regulator

Generic Electives
Sub: Electronic Science

Semester-II

COURSE TITLE: DIGITAL SYSTEM DESIGN

Course code: ELTG-201 **Course No: GE-02**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Marks: 50 **End Semester: 40** **In Semester: 10**

Course Objectives:

This course provides a basic concept on digital world. With this paper, students can have a glimpse of digital number systems, coding, logic gates and digital algebra to implement in electronic devices. This course also includes basic introduction to VHDL and realizing basic digital circuits by VHDL coding, with circuit simulation software as well as in hardware lab.

Unit-1 (15 Lectures, 10 Marks)

Number System and Codes: Decimal, Binary, Hexadecimal, Octal, BCD, Conversions, Complements (1's and 2's), Signed and unsigned numbers, addition and subtraction, multiplication and subtraction, Gray Codes

Boolean algebra and Logic gates: Boolean algebra- Positive and negative logic. Boolean laws. De Morgan's theorems, simplification of Boolean expressions-SOP and POS. Logic gates- basic logic gates-AND, OR, NOT, logic symbol and truth table. Derived logic gates (NAND, NOR, XOR & XNOR). Universal property of NOR and NAND gates. K-map-3 and 4 variable expressions. Characteristics of logic families: Fan In and Fan out, power dissipation and noise Immunity, propagation delay, comparison of TTL and CMOS families.

Unit-2 (11 Lectures, 10 Marks)

Combinational logic analysis and design: Multiplexers and Demultiplexers, Adder (half and full) and their use as subtractor, Encoder and Decoder, Code Converter (Binary to BCD and vice versa)

Unit-3 (16 Lectures, 15 Marks)

Sequential logic design: Latch, Flip flop, S-R FF , J-K FF, T and D type FFs, clocked FFs, registers, Counters (ripple, synchronous and asynchronous, ring, modulus)

Unit-4 (18 Lectures, 15 Marks)

VHDL: A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches.

VHDL: Module, Delays, brief description - data flow style, behavioral style, structural style, mixed design style, simulating design.

A-D and D-A Conversion: D-A conversion: 4 bit binary weighted resistor type, circuit and working. Circuit of R-2R ladder- Basic concept. A-D conversion characteristics, successive approximation ADC.

Suggested books:

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
5. A Verilog HDL Primer – J. Bhasker, BSP, 2003 II Edition.
6. Verilog HDL-A guide to digital design and synthesis-Samir Palnitkar, Pearson, 2nd edition.

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Digital System Design Lab (Hardware and Circuit Simulation Software)

60 Periods

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 IC's.
3. Design a Half and Full Adder.
4. Design a Half and Full Subtractor.
5. Design a seven segment display driver.
6. Design a 4 X 1 Multiplexer using gates.
7. To build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type).
8. Design a counter using D/T/JK Flip-Flop.
9. Design a shift register and study Serial and parallel shifting of data.
10. Design a digital to Analog and Analog to Digital converter of given specification.

VHDL

1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder using basic and derived gates.
3. Half subtractor and Full Subtractor using basic and derived gates.

Generic Electives
Sub: Electronic Science

Semester-III
COURSE TITLE: INSTRUMENTATION
Course code: ELTG-301 **Course No: GE-03**
Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Marks: 50 **End Semester: 40** **In Semester: 10**

Course Objectives:
Electronic Instrumentation paper assists students to recognize the configurations and functional explanation of measuring instruments, their basic performance, working principles, and characteristics. The course includes oscilloscopes, signal generators, Sensors, Transducers and various instruments of electronics for multidisciplinary fields.

Unit-1 (10 Lectures, Marks 10)
DC and AC indicating Instruments: Accuracy and precision, Types of errors, PMMC galvanometer, sensitivity, Loading effect , Conversion of Galvanometer into ammeter, Voltmeter and Shunt type ohmmeter, Multimeter.

Unit- 2 (18 Lectures, Marks 15)
Oscilloscopes: CRT, wave form display and electrostatic focusing, time base and sweep synchronisation, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Dual trace oscilloscope, Sampling Oscilloscope, DSO and Powerscope: Block diagram, principle and working, Advantages and applications, CRO specifications (bandwidth, sensitivity, rise time).
Signal Generators: Audio oscillator, Pulse Generator, Function generators.

Unit - 3 (12 Lectures, Marks10)
Transducers: Basic requirements of transducers, Transducers for measurement of non-electrical quantities: Types and their principle of working , measurement of Linear displacement, Acceleration, Flow rate, Liquid level, strain, Force, Pressure, Temperature.

Unit - 4 (20 Lectures, Marks15)
Data acquisition systems: Block diagram, brief description of preamplifier, signal conditioner, instrumentation amplifier, waveform generator, A/D and D/A converter blocks, computer controlled test and measurement system.
Bio-medical instrumentation: Bio-Amplifiers: Bio potentials - Bio-electricity - Necessity for special types of amplifiers for biological signal amplifications - Different types of Bio-OP - Amps. Electrodes for ECG, EEG, and EMG, block diagram of ECG and EEG systems, brief analysis of graphs.

Suggested Books:

1. Electrical Measurement in Measuring Instruments. Goldwing E.W. and Widdies
2. Electrical and Electronics Measurement and Instrumentation Sahwany A.K.
3. Instrumentation devices and systems: Rangan, Sarma, Mani, TMH
4. Instrumentation measurement and analysis: Nakra B C, Chaudry K K, TMH
5. Handbook of biomedical instrumentation: Khandpur R S, TMH
6. Measurement systems applications and design: Doeblin E O, McGraw Hill, 1990.
7. Electron measurements and instrumentation techniques: Cooper W D and Helfric A D, PHI, 1989.
8. Biomedical instrumentation and measurements: Leslie-Cromwell, Fred J Weibell, Erich A Pfieffer, PHI, 1994.
9. Mechatronics – principles and applications, Godfrey C Onwubolu, Elsevier, 2006.

Practical: 02 Credits

Total Practical Marks: 35 End Semester: 30 In Semester: 5

Instrumentation Lab

60 Periods

1. Design of multi range ammeter and voltmeter using galvanometer.
2. To determine the Characteristics of resistance transducer - Strain Gauge (Measurement of Strain using half and full bridge.)
3. To determine the Characteristics of LVDT.
4. To determine the Characteristics of Thermistors and RTD.
5. Measurement of temperature by Thermocouples and study of transducers like AD590 (two terminal temperature sensor), PT-100, J- type, K-type.
6. Characterization of bio potential amplifier for ECG signals.
7. Study on ECG simulator
8. Measurement of heart sound using electronic stethoscope. Study on ECG heart rate monitor /simulator
9. Study of pulse rate monitor with alarm system
10. Measurement of respiration rate using thermister /other electrodes.

Generic Electives
Sub: Electronic Science

Semester-IV

COURSE TITLE: CONSUMER ELECTRONICS

Course code: ELTG-401 **Course No: GE-04**

Credits: 06(04-Theory, 02-Practical) **No. of Classes: 60**

Total Marks: 50 **End Semester: 40** **In Semester: 10**

Course Objectives:

Students will know about the common electronic goods. The basic applications and maintenainence of different electronic equipments are highlighted here. The course includes audio system, TV and video system, telephone, Electronic gadgets and home appliances etc.

Unit -1 (10 Lectures, Marks 10)

Audio systems: PA system, Microphone, Amplifier, Loudspeakers. Radio receivers, AM/FM. Audio recording and reproduction, Cassettes, CD and MP3.

Unit-2 (16 Lectures, Marks 10)

TV and Video systems: Television standards, BW/Colour, CRT/HDTV. Video system, VCR/VCD/DVD players, MP4 players, Set Top box, CATV and Dish TV, LCD, Plasma & LED TV. Projectors: DLP, Home Theatres, Remote Controls

Unit-3 (17 Lectures, Marks 15)

Landline and Mobile telephony: Basic landline equipment, CLI, Cordless. Intercom/ EPABX system. Mobile phones: GPRS & Bluetooth. GPS Navigation system. Smart Phones **Office Equipment:** Scanners, Barcode / Flat bed, Printers, Xerox, Multifunction units (Print, Scan, fax, and copy)

Unit-4 (17 Lectures, Marks 15)

Electronic Gadgets and Domestic Appliances: Digital clock, Digital camera, Handicam, Home security system, CCTV. Air conditioners, Refrigerators, Washing Machine/Dish Washer, Microwave oven, Vacuum cleaners

Suggested Books:

1. R. P. Bali Consumer Electronics Pearson Education (2008)
2. R. G. Gupta Audio and Video systems Tata McGraw Hill (2004)

Practical: 02 Credits

Total Practical Marks: 35 **End Semester: 30** **In Semester: 5**

Consumer Electronics Lab

60 Periods

1. Study of PA systems for various situations – Public gathering, closed theatre /Auditorium, Conference room, Prepare Bill of Material (Costing)

2. Installation of Audio /Video systems – site preparation, electrical requirements, cables and connectors
3. Market Survey of Products (at least one from each module)
4. Identification of block and tracing the system. Assembly and Disassembly of system using Toolkit.