SCIENCE COLLEGE (AUTONOMOUS)

HINJILICUT, GANJAM, ODISHA

COURSES OF STUDIES

FOR

ELECTRONICS

First Semester Examination-	**2019-20**
Second Semester Examination-	**2019-20**
Third Semester Examination-	**2020-21**
Fourth Semester Examination-	**2020-21**
Fifth Semester Examination-	**2021-22**
Sixth Semester Examination-	**2021-22**

Course Structure

Details of course under B.Sc. (Honours)

COURSE STRUCTURE OF U.G. ELECTRONICS HONOURS						
SEM.	**COURSE OPTED**	**COURSE NAME**	**Full Marks**	**End-term Marks**	**Mid-term marks**	**CREDITS**
SEM. I	AECC-I	Environmental Science	100	80	20	4
	Core course-I **(Practical/Tutorial)**	Basic Circuit Theory and Network Analysis (Lab)	100	60+25 =85	15	4+2=6
	Core course-II **(Practical/Tutorial)**	Mathematics Foundation for Electronics (Lab)	100	60+25 =85	15	4+2=6
	Generic Elective –I **(Practical/Tutorial)**		100			4+2=6 5+1=6
			400			**22**
SEM. II	AECC-II	MIL (Odia Communication/ Alternative English)	100	80	20	4
	Core Course-III **(Practical/Tutorial)**	Semiconductor Devices (Lab)	100	60+25 =85	15	4+2=6
	Core course-IV **(Practical/Tutorial)**	Applied Physics (Lab)	100	60+25 =85	15	4+2=6
	Generic Elective -2 **(Practical/Tutorial)**	Electronic Circuit And PCB Design) (Lab)	100	60+25 =85	15	4+2=6
			400			**22**
SEM. III	Core course-V **(Practical/Tutorial)**	Electronic Circuits (Lab)	100	60+25 =85	15	4+2=6
	Core course-VI **(Practical/Tutorial)**	Digital Electronics and VHDL(Lab)	100	60+25 =85	15	4+2=6
	Core course-VII **(Practical/Tutorial)**	C Programming and Data Structures (Lab)	100	60+25 =85	15	4+2=6
	Generic Elective -2 **(Practical/Tutorial)**		100			4+2=6 5+1=6
	SECC-I	Communicative English	100	80	20	4
			500			**28**
SEM. IV	Core course-VIII **(Practical/Tutorial)**	Operational Amplifiers and Applications (Lab)	100	60+25 =85	15	4+2=6
	Core course-IX **(Practical/Tutorial)**	Signals and Systems (Lab)	100	60+25 =85	15	4+2=6
	Core course-X **(Practical/Tutorial)**	Electronic Instrumentation (Lab)	100	60+25 =85	15	4+2=6
	Generic Elective -3 **(Practical/Tutorial)**	Digital System Design (Lab)	100	60+25 =85	15	4+2=6

	SECC-II	Quantitative & Logical Thinking	100	80	20	4
			500			**28**
SEM. V	Core course-XI **(Practical/Tutorial)**	Microprocessors and Microcontrollers (Lab)	100	60+25 =85	15	4+2=6
	Core course-XII **(Practical/Tutorial)**	Electromagnetics (Lab)	100	60+25 =85	15	4+2=6
	DSE-I **(Practical/Tutorial)**	Power Electronics (Lab)	100	60+25 =85	15	4+2=6
	DSE-II **(Practical/Tutorial)**	Numerical Techniques (Lab)	100	60+25 =85	15	4+2=6
			400			**24**
SEM. VI	Core course-XIII **(Practical/Tutorial)**	Communication Electronics (Lab)	100	60+25 =85	15	4+2=6
	Core course-XIV **(Practical/Tutorial)**	Photonics (Lab)	100	60+25 =85	15	4+2=6
	DSE-III **(Practical/Tutorial)**	Control System (Lab)	100	60+25 =85	15	4+2=6
	DSE-IV	Dissertation (Lab)	100			6
			400			**24**
			2600			**148**

Scheme for Choice Based Credit System in B.Sc.(Honours) Electronics

	CORE COURSE (14)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (2)	Elective: Discipline Specific DSE (4)	Elective: Generic(GE) (4)
I	Basic Circuit Theory and Network Analysis Mathematics Foundation for Electronics	Environmental Science			**GE-1** Physics
II	Semiconductor Devices Applied Physics	MIL (Odia Communication/ Alternative English)			**GE-2** Mathematics
III	Electronic Circuits Digital Electronics and VHDL C Programming and Data Structures		**SEC -1** Communicative English		**GE-3** Physics
IV	Operational Amplifiers and Applications Signals and Systems Electronic Instrumentation		**SEC -2** Quantitative & Logical Thinking		**GE-4** Mathematics
V	Microprocessors and Microcontrollers Electromagnetics			**DSE-1** Power Electronics **DSE -2** Numerical Techniques	
VI	Communication Electronics Photonics			**DSE -3** Control Systems **DSE -4** Dissertation	

CORE COURSE(CC): (Credit: 06 each)

1. Basic Circuit Theory and Network Analysis
2. Mathematics Foundation for Electronics
3. Semiconductor Devices
4. Applied Physics
5. Electronic Circuits
6. Digital Electronics and VHDL
7. C Programming and Data Structures
8. Operational Amplifiers and Applications
9. Signals and Systems
10. Electronic Instrumentation
11. Microprocessors and Microcontrollers
12. Electromagnetics
13. Communication Electronics
14. Photonics

Discipline Specific Electives (DSE): (Credit: 06 each) – DSE-1 to DSE-4

1. Power Electronics
2. Numerical Analysis
3. Control Systems
4. Dissertation

Skill Enhancement Course (SEC) (Credit: 02)

1. Design and Fabrication of Printed Circuit Boards **(SEC-2)**

Generic Elective Papers (GE for other Departments/ Displines) : (Credit: 06 each)
GE-1 and GE-2

1. Electronic Circuits and PCB Designing **(GE-2)**
2. Digital System Design **(GE-4)**

CORE PAPERS

ELECTRONICS-SEMESTER-I

Core Course I: Basic Circuit Theory and Network Analysis – 100 marks

(Credits-6: Theory-4, Practical-2)

THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)

[75 marks (Mid Sem 15 + End Sem 60)]

Lectures: 60 [40 Theory + 20 Practical classes]

Unit- 1 (13 Lectures)

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, 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)

Circuit Analysis: Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Star-Delta Conversion, Source Transformation, Node Analysis, Mesh Analysis.

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)

AC Circuit Analysis: Sinusoidal Voltage and Current, Definition of Instantaneous Current, Peak to Peak, Root Mean Square and Average Values. Voltage-Current relationship in Resistor, Inductor and Capacitor, **Power in AC Circuits**: Instantaneous Power, Average 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.

Unit-4 (16 Lectures)

Network Theorems: Principal of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Millman's Theorem, Maximum Power Transfer Theorem, AC circuit analysis using Network theorems.

Two port Networks: Impedence(Z) Parameters, Admittance (Y) 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)

CORE-1(LAB)
MARK-25

Basic Circuit Theory and Network Analysis Lab (Hardware and Circuit Simulation Software) 30 Lectures

1. Familiarization with
a) Resistance in series, parallel and series–Parallel.
b) Multimeter Basics
c) Voltage sources in series, parallel and series – Parallel
d) Voltage and Current dividers

2. Determination of resistance by Colour Code Identification and circuit symbols of different electronic components.
3. Measurement of Amplitude, Frequency & Phase difference using CRO.
4. Verification of Kirchoff's Law.
5. Verification of Norton's theorem.
6. Verification of Thevenin's Theorem.
7. Verification of Superposition Theorem.
8. Verification of the Maximum Power Transfer Theorem.
9. RC Circuits: Time Constant, Differentiator, Integrator.
10. Designing of a Low Pass RC Filter and study of its Frequency Response.
11. Designing of a High Pass RC Filter and study of its Frequency Response.
12. 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.

ELECTRONICS-SEMESTER-I
Core Course II: Mathematics Foundation for Electronics – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1

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.

Unit-2 (14 Lectures)

Matrices: Introduction to Matrices, Unitary Matrices, Real and Complex Matrices, Symmetric Matrices, Skew Symmetric Matrices, Hermitian and Skew-Hermitian Matrices, Orthogonal Quadratic Form of Matrices, Eigen Value, Eigen Vector, Cayley-Hamilton Theorem, Diagonalization, System of Linear Algebric Equation, Gauss elimination method, Gauss-Jordan elimination method, Gauss-Seidal method, LU decomposition method, Solution of Linear system by LU decomposition.

Unit-3 (14 Lectures)

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)

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

CORE-2(LAB)
MARKS-25

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

30 Lectures

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.

ELECTRONICS-SEMESTER-II
Core Course III: Semiconductor Devices – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit 1 (14 Lectures)

Semiconductor Basics: Introduction to Semiconductor Materials, Crystal Structure, 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)

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 Abrupt 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)

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)

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).

Power Devices: UJT, Basic construction and working, Equivalent circuit, 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)

CORE-3(LAB)
MARK-25

Semiconductor Devices Lab (Hardware and Circuit Simulation Software)

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

ELECTRONICS-SEMESTER-II
Core Course IV: Applied Physics – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (19 Lectures)

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.

Unit-2 (11 Lectures)

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)

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, Thermal Conductivity, Thermoelectricity, Seebeck Effect, Thomson Effect, Peltier Effect.

Unit-4 (15 Lectures)

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.

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)

CORE-4(LAB)
MARK-25
Applied Physics Lab

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.

ELECTRONICS-SEMESTER-III
Core Course V: Electronics Circuits – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit- 1 (14 Lectures)

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)

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, voltage divider bias and emitter bias (+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)

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)

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. Circuit operation of complementary symmetry Class B push pull power amplifier, crossover distortion, heat sinks.
Single tuned amplifiers: Circuit diagram, Working and Frequency Response for each, Limitations of single tuned amplifier, Applications of tuned amplifiers 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

CORE-5(LAB)
MARK-25

Electronics Circuits Lab (Hardware and Circuit Simulation Software)

30 Lectures

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.

ELECTRONICS-SEMESTER-III
Core Course VI: Digital Electronics and VHDL– 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (11 Lectures)

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, Basic postulates and fundamental theorems of Boolean algebra, Truth tables, construction and symbolic representation of XOR, XNOR, Universal (NOR and NAND) gates.

Unit-2 (13 Lectures)

Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS), Min-Max term and its Representation**,** Karnaugh map (upto 4 variables), Simplification of Logical Functions using K-Map, Half and Full Adder, Half and Full Subtractor, Encoder, Decoder, Multiplexer, De-multiplexer.

Unit-3 (18 Lectures)

Sequential logic design: One bit Memory cell, 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.

Unit-4 (18 Lectures)

Circuit Design: Registers: SISO, SIPO, PISO, PIPO, Counters: Synchronous, Asynchronous , State Table, State Diagram, Counter design using table, Ring Counter, Johnson Counter.
Introduction to VHDL: A Brief History of HDL, Structure of HDL Module, Comparison of VHDL , Introduction to Simulation and Synthesis Tools, VHDL Modules, Delays, data flow style, behavioral style, structural style, mixed design style, simulating design, 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.
Behavioral Modeling: Introduction to behavioral modeling, inertial delay, transport delay , inertial delay model, transport delay model, transport vs. inertial delay. Conditional State (if-else, if-elsis, CASE, when-else, with-select), **Sequential Processing:** Process statement, sensitivity list, signal assignment vs. variable assignment, sequential statements and programme.

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.

CORE-6(LAB)
MARK-25

Digital Electronics and VHDL Lab (Hardware and Circuit Simulation Software)

1. To study and verify the characteristics of Basic Logic Gates.
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. Design a Half and Full Adder.
4. Design a Half and Full Subtractor.
5. Design a seven segment display driver.
6. Design a 8 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.

Experiments in 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.

ELECTRONICS-SEMESTER-III
Core Course VII: C Programming and Data Structures– 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit- 1 (12 Lectures)

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.

Unit-2 (19 Lectures)

Decision making, branching & looping: Decision making, branching and 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.

Unit-3 (15 Lectures)

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 Double Linked List.

Unit-4 (14 Lectures)

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.

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.

CORE-7(LAB)
MARK-25

C Programming and Data Structures Lab

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.
6. Generate and print prime numbers up to an integer N.
7. Sort given N numbers in ascending order.
8. Find the sum & difference of two matrices of order MxN and PxQ.
9. Find the product of two matrices of order MxN and PxQ.
10. Find the transpose of given MxN matrix.
11. Maintain an account of a customer using classes.
12. Create a Linear Queue using Linked List and implement different operations such as Insert, Delete, and Display the queue elements.
13. Create a Binary Tree to perform Tree traversals (Preorder, Postorder, Inorder) using the concept of recursion.
14. Implement binary search tree using linked lists. Compare its time complexity over that of linear search.
15. Implement Insertion sort, Merge sort, Bubble sort, Selection sort.

ELECTRONICS-SEMESTER-IV
Core Course VIII: Operational Amplifiers and Applications– 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (18 Lectures)

Integrated Circuits: Introduction of ICs, Merits, Limitations, Basic Monolithic ICs and its Fabrication,
Basic Operational Amplifier: Characteristics, Block Diagram, Equivalent Circuit, Ideal Op-amp.

Op-Amp parameters: Input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio.

Unit-2 (18 Lectures)

Op-Amp Circuits: Open and closed loop configuration, Inverting, Non-inverting, Summing and difference amplifier, Integrator, Differentiator, Voltage to current converter, Current to voltage converter.
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)

Multivibrators (IC 555): Block diagram, Pin Configuration, Working, Astable and Monostable multivibrator circuit, Applications of Monostable and Astable multivibrators.
IC regulators: IC 78xx and IC 79xx (concepts only)

Unit-4 (12 Lectures)

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

CORE-8(LAB)
MARK-25

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

1. Study of op-amp characteristics.
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

ELECTRONICS-SEMESTER -IV
Core Course IX: Signals & Systems– 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (17 Lectures)

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)

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

Unit-3 (18 Lectures)

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

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

Unit-4 (12 Lectures)

Laplace Transform: Laplace Transform, Inverse Laplace Transform, Properties of the Laplace Transform, Laplace Transform Pairs, Laplace Transform for signals, 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)

CORE-9(LAB)
MARK-25

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

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.

ELECTRONICS-SEMESTER -IV
Core Course X: Electronic Instrumentation– 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (15 Lectures)

Qualities of Measurement: Specifications of instruments, their static and dynamic characteristics, Error (Gross error, systematic error, absolute error and relative error) and uncertainty analysis. Statistical analysis of data and curve fitting.
Basic Measurement Instruments: PMMC instrument, galvanometer, DC measurement - ammeter, voltmeter, **o**hm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating types), digital multimeters, digital frequency meter system (different modes and universal counter).

Unit-2 (15 Lectures)

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, Maxwell's bridge, Hay's bridge, and Anderson's bridge, Measurement of Capacitance, Schering's bridge, DeSauty's bridge, Measurement of frequency, Wien's bridge.

Unit-3 (16 Lectures)

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 Powerscope: Block diagram, principle and working, Advantages and applications, CRO specifications (bandwidth, sensitivity, rise time).
Signal Generators: Audio oscillator, Pulse Generator, Function generators.

Unit-4 (14 Lectures)

RADAR : Block Diagram, description, terminology, Calulation of max. range, Uses.
Transducers: Classification of transducers,Basic requirement/characteristics of transducers, active & passive transducers, Resistive (Potentiometer, Strain gauge – Theory, types, temperature compensation and applications), Capacitive (Variable Area Type – Variable Air Gap type – Variable Permittivity type), Inductive (LVDT) and piezoelectric 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).

CORE-10(LAB)
MARK-25

Electronic Instrumentation Lab

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. Study of transducers like AD590 (two terminal temperature sensor)
8. To study the Characteristics of LDR, Photodiode, and Phototransistor:
   (i) Variable Illumination.
   (ii) Linear Displacement.
9. Characteristics of one Solid State sensor/ Fiber optic sensor

ELECTRONICS-SEMESTER -V
Core Course XI: Microprocessor and Microcontrollers – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (18 Lectures)

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)

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
16- bit and advance microprocessor: Architecture and pin configuration of 8086 and 8088 microprocessor**,**

Unit-3 **(**14 Lectures)

Microcontrollers: Introduction, different types of microcontrollers, embedded microcontrollers, processor architectures. Harvard vs. Princeton, CISC vs. RISC architectures, microcontroller memory types, microcontroller features, clocking, I/O pins, interrupts, timers, peripherals.
ATMEGA16 Microcontroller: Core features, Architecture, pin diagram, pin description, stack pointer, interrupt handling, memory organization, USART, ADC module and operation, system control and RESET.

Unit-4 (18 Lectures)

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.

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

CORE-11(LAB)
MARK-25

Microprocessor and Microcontroller Lab

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.

PIC 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
2. Interfacing of LCD (2X16).
3. Interfacing of stepper motor and Rotating stepper motor by N steps clockwise/anticlockwise with speed control.
4. To test all the gates of a given IC74XX is good or bad.
5. Generate sine, square, saw tooth, triangular and staircase waveform using DAC interface.
6. Display of 4- digit decimal number using the multiplexed 7-segment display interface.
7. Analog to digital conversion using internal ADC and display the result on LCD.
8. Implementation of DC-Volt meter (0-5V) using internal ADC and LCD
9. Digital to analog conversion using PWM (pulse delay to be implemented using timers).
10. Speed control of DC motor using PWM (pulse delay to be implemented using timers).
11. Interfacing of matrix keyboard (4X4).
12. Serial communication between microcontroller and PC.

ELECTRONICS-SEMESTER -V
Core Course XII: Electromagnetics– 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (16 Lectures)

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, Capacitance and Capacitors. Electrostatic Energy and Forces.

Unit- 2 (14 Lectures)

Poisson's Equation and Laplace's Equation: Derivation of Poisson's and Laplace's equation, Uniqueness Theorem, Examples of Solution of Laplace's Equation.
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. Magnetization in Materials and Permeability, Anisotropic materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy, Forces and Torques.

Unit-3 (13 Lectures)

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)

Electromagnetic Wave Propagation: Time- Harmonic Electromagnetic Fields and use of Phasors, 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.
Guided Electromagnetic Wave Propagation: 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)

CORE-12(LAB)
MARK-25

Electromagnetics Lab (using Scilab/ any other similar freeware)

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

ELECTRONICS-SEMESTER -VI
Core Course XIII: Communication Electronics– 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (10 Lectures)

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)

Amplitude Modulation: Amplitude Modulation, modulation index and frequency spectrum. 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)

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)

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)

CORE-13(LAB)
MARK-25

Communication Electronics Lab (Hardware and Circuit Simulation Software)

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 Amplitude Shift Keying
9. Study of Phase Shift Keying,
10. Study of Frequency Shift Keying.

ELECTRONICS-SEMESTER -VI
Core Course XIV: Photonics – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (22 Lectures)

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)

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)

Light Emitting Diodes: Construction, materials and operation.

LASER: Interaction of radiation and matter, Einstein coefficients, Examples of common lasers. The semiconductor injection laser diode.

Photodetectors: Bolometer, Photomultiplier tube, Charge Coupled Device. Photo transistors and Photodiodes (p-i-n, avalanche)
LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, applications, advantages over LED displays.

Unit-4 (12 Lectures)

Guided Waves and the Optical Fiber: TE and TM modes in symmetric slab waveguides, 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)

CORE-14(LAB)
MARK-25

Photonics Lab

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.

DISCIPLINE SPECIFIC ELECTIVE

ELECTRONICS-SEMESTER -V
DSE-I: Power Electronics – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit- 1 (12 Lectures)

Power Devices: Introduction to Power Devices and Thyristors
Silicon Controlled Rectifier (SCR): Structure, I-V characteristics, Turn-On and Turn-Off characteristics
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.

Unit- 2 (14 Lectures)

DIAC and TRIAC: Basic structure, working and V-I characteristic, application of a Diac as a triggering device for a Triac, Triac as a switch.
Insulated Gate Bipolar Transistors (IGBT): Basic structure, I-V Characteristics, switching characteristics, device limitations and safe operating area (SOA) etc.
Power MOSFETs: operation modes, switching characteristics, power BJT, second breakdown, saturation and quasi-saturation state.

Unit- 3 (17 Lectures)

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).

Unit- 4 (17 Lectures)

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

DSE-1(LAB)
MARK-25

Power Electronics Lab

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. Study of parallel and bridge inverter.
8. Design of snubber circuit
9. VI Characteristic of MOSFET and IGBT
10. Study of chopper circuits

ELECTRONICS-SEMESTER -V
DSE-II: Numerical Techniques– 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (16 Lectures)

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

Unit-2 (14 Lectures)

Interpolation and Polynomial Approximations: Taylor Series and Calculation of Functions, Langrange Interpolation, Newton Forward, Backward and Divided Difference Interpolation .

Unit-3 (16 Lectures)

Numerical Integration: Trapezoidal Rule, Error bounds and estimate for the Trapezoidal rule, Simpson's $1/3^{rd}$ Rule, $3/8^{th}$ rule, Error of Simpson's rule.
Numerical methods for first order differential equations: Picard's method, Euler-Cauchy Method, Heun's Method, Taylor Series Method to solve 1^{st} order differential equation, , Runge-Kutta method of 2^{nd} and 4^{th} order.

Unit- 4 (14 Lectures)

Numerical Methods in Linear Algebra: Linear systems Ax=B, Gauss Elimination, Partial Pivoting, L-U factorization, Doolittle's, Crout's and Cholesky's method. Matrix Inversion, Gauss-Jordon Method.
Iterative Methods: Gauss-Seidel Iteration, Jacobian Iteration.
Matrix Eigen value: 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).
6. R.S. Salaria, Computer Oriented Numerical analysis, Khanna Publishers.

DSE-2(LAB)
MARK-25

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

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

ELECTRONICS-SEMESTER -VI
DSE-III: Control Systems – 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit 1 (16 Lectures)

Introduction to Control Systems: Open loop and Closed loop control systems, Mathematical modeling of physical systems (Electrical, Mechanical and Thermal), Derivation of transfer function, Armature controlled and field controlled DC servomotors, AC servomotors, block diagram representation & signal flow graph, Reduction Technique, Mason's Gain Formula. Effect of feedback on control systems.

Unit 2 (14 Lectures)

Time Domain Analysis: Time domain performance criteria, transient response of first, second & higher order systems, steady state errors and static error constants, Performance indices.
Concept of Stability: Asymptotic stability and conditional stability, Routh – Hurwitz criterion, relative stability analysis, Root Locus plots and their applications.

Unit 3 (14 Lectures)

Frequency Domain Analysis: Correlation between time and frequency response, Polar and inverse polar plots, frequency domain specifications, Logarithmic plots (Bode Plots), gain and phase margins, Nyquist stability criterion, relative stability using Nyquist criterion, constant M & N circles.

Unit 4 (16 Lectures)

State Space Analysis: Definitions of state, state variables, state space, representation of systems, Solution of time invariant, homogeneous state equation, state transition matrix and its properties.
Controllers and Compensation Techniques: Response with P, PI and PID Controllers, Concept of compensation, Lag, Lead and Lag-Lead networks

Suggested Books:

1. J. Nagrath& M. Gopal, Control System Engineering, New Age International, 2000
2. K. Ogata, Modern Control Engineering, PHI 2002
3. B. C. Kuo , "Automatic control system", Prentice Hall of India, 2000

DSE-3(LAB)
MARK-25

Control Systems Lab (Hardware and Scilab/MATLAB/Other Mathematical Simulation software)
30 Lectures

1. To study characteristics of: a. Synchro transmitter receiver, b. Synchro as an error detector
2. To study position control of DC motor
3. To study speed control of DC motor
4. To find characteristics of AC servo motor
5. To study time response of type 0, 1 and 2 systems
6. To study frequency response of first and second order systems
7. To study time response characteristics of a second order system.
8. To study effect of damping factor on performance of second order system
9. To study frequency response of Lead and Lag networks.
10. Study of P, PI and PID controller.

SKILL ENHANCEMENT COURSE

ELECTRONICS-SEMESTER -IV

SEC –II: Design and Fabrication of Printed Circuit Boards– 50 marks

(Credits-2: Lectures: 30) THEORY (Each class 1 hour)

[50 marks (Mid Sem 10 + End Sem 40)]

Unit-1 **(15 Lecturer)**

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. Tracks, Pads, Vias, power plane, grounding.

Unit-2 **(15 Lecturer)**

Technology OF PCB: Design automation, Design Rule Checking, 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

GENERIC ELECTIVE

ELECTRONICS-SEMESTER -II
GENERIC ELECTIVE-II: Electronic Circuits and PCB Designing– 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (12 Lectures)

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)

Semiconductor Diode and its applications: PN junction diode and characteristics.
Rectifiers: HWR, FWR (center tapped and bridge FWR), Circuit diagrams, working and waveforms, ripple factor & efficiency.
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)

BJT and Amplifiers : Bipolar Junction Transistor, Construction, principle & working of NPN transistor. Configuration: CE, CB, CC. Definition of α, β and γ and their interrelations, 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.
BJT as CE, CB Amplifier, RC Coupled Amplifier, Transformer Coupled Amplifier. (Construction , Working and Frequency Response Curves)

Unit-4 (18 Lectures)

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 ICs.

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.
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.

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.

GE-2(LAB)
MARK-25

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

30 lectures

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
8. Design and study of voltage divider biasing.
9. Designing of an CE based amplifier of given gain
10. Design, fabrication and testing of a 9 V power supply with zener regulator

ELECTRONICS-SEMESTER -IV
GENERIC ELECTIVE-IV: Digital System Design– 100 marks
(Credits-6: Theory-4, Practical-2)
THEORY (Each class 1 hour): PRACTICAL (Each class 2 hours)
[75 marks (Mid Sem 15 + End Sem 60)]
Lectures: 60 [40 Theory + 20 Practical classes]

Unit-1 (15 lectures)

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.

Unit-2 (11 lectures)

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)

Sequential logic design: One bit Memory cell, 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.

Unit-4 (18 Lectures)

Circuit Design: Registers: SISO,SIPO,PISO,PIPO ,**Counters**: Syncronous, Asyncronous , State Table, State Diagram, Counter design using table, Ring Counter, Johnson Counter.

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)

GE-4 (LAB)
MARK-25

Digital System Design Lab (Hardware and Circuit Simulation Software)

30 lectures

1. To study and verify the characteristics of Basic Logic Gates.
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. Design a Half and Full Adder.
4. Design a Half and Full Subtractor.
5. Design a seven segment display driver.
6. Design a 8 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.