SCHOOL OF STUDIES OF PHYSICAL SCIENCE
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A CENTRAL UNIVERSITY)

CBCS/LOCF-NEW, SYLLABUS

DEPARTMENT OF PURE AND APPLIED PHYSICS
B. Sc. (Electronics) Course structure under CBCS/LOCF
Academic Year 2021 – 22

Sem	Course	Course Code	Course Name	Credits	Credits (T+L+P)	Internal Marks/	ESE Max. Marks	Total Marks
I	Core 1	PLUATT1	Mathematical Foundation for Electronics	5	4+1+0	30	70	100
	Core 2	PLUATT2	Basic Circuit Theory and Network Analysis	3	3+0+0	30	70	100
		PLUALT2	Basic Circuit Theory and Network AnalysisLab	2	0+0+2	30	70	100
	GE-1		Opted from the pool course and offered by sister Departments	5		30	70	100
	AEC-1		Opted from the pool course and offered by University	2		30	70	100
	SEC-1		Opted from the pool course and offered by University	2		30	70	100
	Total			**19**				**600**
II	Core 3	PLUBTT1	Semiconductor Devices	3	3+0+0	30	70	100
		PLUBLT1	Semiconductor Devices Lab	2	0+0+2	30	70	100
	Core 4	PLUBTT2	Applied Physics	3	3+0+0	30	70	100
		PLUBLT2	Applied Physics Lab	2	0+0+2	30	70	100
	GE-2		Opted from the pool course and offered by sister Departments	5		30	70	100
	AEC-2		Opted from the pool course and offered by University	2		30	70	100
	SEC 2		Opted from the pool course and offered by University	2		30	70	100
	Total			**19**				**700**
III	Core 5	PLUCTT1	Electronic Circuits	3	3+0+0	30	70	100
		PLUCLT1	Electronic Circuits Lab	2	0+0+2	30	70	100
	Core 6	PLUCTT2	Digital Electronics and VHDL	3	3+0+0	30	70	100
		PLUCLT2	Digital Electronics Lab	2	0+0+2	30	70	100
	Core 7	PLUCTT3	C/ C^{++} Programming and Data Structures	3	3+0+0	30	70	100
		PLUCLT3	C/ C^{++} Programming and Data Structures Lab	2	0+0+2	30	70	100
	GE-3		Opted from the pool course and offered by sister Departments	5		30	70	100
	AEC-3		Opted from the pool course and offered by University	2		30	70	100
	Additional Credit Courses							
Total				**22**				**800**
IV	Core 8	PLUDTT1	Signals and Systems	5	4+1+0	30	70	100
	Core 9	PLUDTT2	Operational Amplifiers and Applications	3	3+0+0	30	30	100
		PLUDLT2	Operational Amplifiers	2	0+0+2	30	70	100

			and Applications Lab					
	Core 10	PLUDTT3	Electronics Instrumentations	3	3+0+0	30	70	100
		PLUDLT3	Electronics Instrumentations Lab	2	0+0+2	30	70	100
	GE - 4		Opted from the pool course and offered by sister Departments	5		30	70	100
	AEC -4		Opted from the pool course and offered by University	2		30	70	100
	Internship*			6**		30	70	100
	Additional Credit Course							
		Total		**22+6****				**800**
V	Core 11	PLUETT1	ElectromagneticTheory	5	4+1+0	30	70	100
	Core 12	PLUETT2	Microprocessors and Microcontrollers	3	3+0+0	30	70	100
		PLUELT2	Microprocessors and Microcontrollers Lab	2	0+0+2	30	70	100
	DSE - 1	PLUETD1	Nano Electronics	3	3+0+0	30	70	100
		PLUELD1	Nano Electronics Lab	2	0+0+2	30	70	100
	DSE - 2	PLUETD2	Numerical Techniques	3	3+0+0	30	70	100
		PLUELD2	Numerical Techniques Lab	2	0+0+2	30	70	100
	AEC-5		Opted from the pool department and offered by pool departments	2		30	70	100
	Additional Credit Courses							
VI	Core 13	PLUFTT1	Semiconductor Fabrication & Characterization	3	3+0+0	30	70	100
		PLUFLT1	Semiconductor Materials Lab	2	0+0+2	30	70	100
	Core 14	PLUFTT2	Communication Electronics	3	3+0+0	30	70	100
		PLUFLT2	Communication Electronics Lab	2	0+0+2	30	70	100
	DSE 3	PLUFTD1	Photonic Devices and Power Electronics	3	3+0+0	30	70	100
		PLUFLD1	Photonics Devices and Power Electronics Lab	2	0+0+2	30	70	100
	Seminar	PLUFS01#	Seminar	2		30	70	100
	Dissertation	PLUFD01#	Dissertation/ project work followed by seminar	7		30	70	100
	Total			**23**				**800**
Ability Enhancement Course (AEC) offered by Department								
1	AEC	AECPL01	Electronics in daily life	2	2+0+0	30	70	100
2	AEC	AECPL02	Organic Electronics	2	2+0+0	30	70	100
Skill Enhancement Courseoffered by Department								
1	SEC	SECPL01	Network Circuit Analysis	2	1+0+1	30	70	100
2	SEC	SECPL02	Simulation and Design of Digital Circuit Components	2	1+0+1	30	70	100
Generic Elective offered by Department								
1	GE	PLUATG1	Basic Circuit Theory and Network Analysis	3	3+0+0	30	70	100
		PLUALG1	Basic Circuit Theory and Network Analysis Lab	2	0+0+2	30	70	100
2	GE	PLUBTG2	Applied Physics	3	3+0+0	30	70	100
		PLUBLG2	Applied Physics Lab	2	0+0+2	30	70	100
3	GE	PLUCTG3	Electronic Circuits	3	3+0+0	30	70	100
		PLUCLG3	Electronic Circuits Lab	2	0+0+2	30	70	100
4	GE	PLUDTG4	Operational Amplifiers and Applications	3	3+0+0	30	70	100

		PLUDLG4	Operational Amplifiers and Applications Lab	2	0+0+2	30	70	100

#The Code generated by the Department.

PHY- Physics, T- Theory, P- Practical, S- Seminars

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DEPARTMENT OF PURE AND APPLIED PHYSICS

B. Sc. (Electronics) Course structure under CBCS/LOCF

Academic Year 2021 – 22

Programme Outcomes: B. Sc. (Electronics)

PO1: Knowledge: Develop a deeper understanding and gain extensive knowledge in various areas of basic and applied electronics.

PO2: Problem Solving Ability: To enhance problem solving ability in case of different problems related to fundamental and technologically oriented electronics.

PO3: Tools & Techniques: Learn various tools and techniques for design, synthesis, optimization of circuits and devices.

PO4: Investigation: Learn to investigate complex problems relate to circuit optimization based on available data and to apply it to synthesize various circuits and systems.

PO5: Society & Environment: Apply the knowledge to asses societal, health, safety, legal and cultural issues and understand the importance of environment for sustainable development.

PO6: Communication and Presentation Skills: Acquire the strong communication and presentation capabilities related to scientific/technological or other social issues.

PO7: Development: Layout design circuit synthesis, optimization and realization as well as design synthesis and optimization of devices.

PO8: Automation: To Learn automation of the machines and systems using microprocessors and microcontrollers.

PO9: Independent & Team Work: Enhance the critical thinking ability, become inquisitive and handle the problems independently as well as manage with team work.

PO10: Carrier: Gain motivations to-opt for M. Sc./M. Tech. in electronics or related areas and apply for various job positions in industries, research & academic institutions.

PO11: Ethics: Apply ethical principles in professional as well as daily life and become persons of integrity and responsibility.

PO12: Life-long Learning: Strive for novel ways of thinking and develop life-long learning attitude.

Programme Specific Outcomes:

PSO1: To attain fundamental knowledge of mathematical methods in electronics, basic circuit theory, network analysis, design and synthesis of circuits using VHDL tools.

PSO2: To acquire basic idea about coding using high level languages, electronic circuits using various components and basics of semiconductor devices along with applied physics.

PSO3: Acquire skills about working of OP AMPS, signals and systems, electronic instrumentation and to apply microprocessors and microcontrollers for automation of the instruments and machines.

PSO4: Gain skills about semiconductors devices, fabrication and characterization of different types of devices. Concepts of simulation, design of digital circuits, network circuit analysis and organic electronics.

PSO5: Students equipped to familiar with the use of electronics in daily life for the smooth operation/functioning of various electronic components and systems required for domestic and industrial purposes.

PSO6: To train the students regarding design of digital circuits and simulation of various components/devices used in different electronics based system development.

Semester - I

Core -1: Mathematical Foundation for Electronics
Course Code: PLUATT1 **Credits = 5 (4+1+0)**

Course Objective:

- To build the strong foundation in Mathematics of students needed for the field of electronics and Telecommunication production
- Solve higher order linear differential equation and matrix using appropriate techniques for modeling and analyzing electrical circuits.

Course Outcome:

- Demonstrate basic knowledge of solving differential equations, introduction to special functions like Bessel and Legendre.
- Demonstrate basic knowledge of Matrix Theory, convergence and divergence of a series and Complex Integration

Unit – I: 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.

Unit – II: Matrices: Introduction to Matrices, System of Linear Algebraic Equations ,Gaussian Elimination Method, 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 – III: Sequences and series: Sequences,Limitofasequence,Convergence,DivergenceandOscillationofa 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 – IV: Complex Variables and Functions: Complex Variable, Complex Function, Continuity, Differentiability, Analyticity. Cauchy-Riemann (C- R) Equations, Harmonic and Conjugate Harmonic Functions, Exponential Function, 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.

Reference Books:

1. E. Kreyszig, advanced engineering mathematics, Wiley India (2008)
2. MurraySpiegel,SeymourLipschutz,JohnSchiller,OutlineofComplexVariables,SchaumOutlineS eries, Tata McGraw Hill (2007)
3. R.K. Jain andS.R.K.Iyengar,AdvancedEngineeringMathematics,NarosaPublishingHouse(2007)
4. C .R. Wylie and L. C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill (2004)
5. B.V.Ramana,HigherEngineeringMathematics,TataMcGrawHillPublishingCompanyLimited(2 007)

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1		1	1		1	1							3			2		2
CO2		1	1		1	1							3			2		2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core -2: Basic Circuit Theory and Network Analysis
Course Code: PLUATT2 **Credits = 3 (3+0+0)**

Course Objectives:

- The objective of the course is that the student acquires the knowledge of basics of electrical network.
- To gain the knowledge and critical analysis of electrical circuit using network theorem.

Course Outcomes:

- Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using different network theorems.
- Student will understand the resonance in series and parallel circuits and also the importance of initial conditions and their evaluation.

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

Unit – II: DC Transient Analysis: RC Circuit- Charging and discharging with initial charge, RL Circuit with Initial Current, Time Constant, RL and RC Circuits, DC Response of Series RLC Circuits.

Unit – III: AC Circuit Analysis: Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak to Peak, Root Mean Square and Average Values. Power in AC Circuits &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 – IV: Network Theorems:Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Millman's Theorem, Maximum Power Transfer Theorem.
Two Port Networks: Impedance (Z) Parameters, Admittance (Y) Parameters, Transmission (ABCD) Parameters.

Reference 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)
6. Grob's Basic Electronics, 11th ed., Mitchel E. Schultz, McGraw Hill.

Course Outcomes and their mapping with Programme Outcomes

CO	PO												PSO					
	PO1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	1		1	1	1							3			2		
CO2	1	1		1	1	1							3			2		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core - 2: Basic Circuit Theory and Network Analysis Lab
Course Code: PLUALT2 **Credits = 2 (0+0+2)**
Name of Experiments
1. Verification of Kirchhoff's Law.
2. Verification of Norton's theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Superposition Theorem.
5. Verification of the Maximum Power Transfer Theorem.
6. Charging and discharging of Capacitor
7. Designing of a Low Pass RC Filter and study of its Frequency Response.
8. Designing of a High Pass RC Filter and study of its Frequency Response.
9. 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.
10. 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.

GE - 1: Basic Circuit Theory and Network Analysis
Course Code: PLUATG1 **Credits = 3 (3+0+0)**

Course Objectives:
- The objective of the course is that the student acquires the knowledge of basics of electrical network.
- To gain the knowledge and critical analysis of electrical circuit using network theorem.

Course Outcomes:
- Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using different network theorems.
- Student will understand the resonance in series and parallel circuits and also the importance of initial conditions and their evaluation.

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

Unit – II: DC Transient Analysis: RC Circuit- Charging and discharging with initial charge, RL Circuit with Initial Current, Time Constant, RL and RC Circuits, DC Response of Series RLC Circuits.

Unit – III: AC Circuit Analysis: Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak to Peak, Root Mean Square and Average Values. Power in AC Circuits &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 – IV: Network Theorems:Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Millman's Theorem, Maximum Power Transfer Theorem.
Two Port Networks: Impedance (Z) Parameters, Admittance (Y) Parameters, Transmission (ABCD) Parameters.

Reference Books:

7. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004).
8. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill.(2005).
9. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
10. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005).
11. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)
12. Grob's Basic Electronics, 11^{th} ed., Mitchel E. Schultz, McGraw Hill.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	1		1	1	1							3			2		
CO2	1	1		1	1	1							3			2		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

GE - 1: Basic Circuit Theory and Network Analysis Lab
Course Code: PLUALG1 **Credits = 2 (0+0+2)**
Name of Experiments
1. Verification of Kirchhoff's Law.
2. Verification of Norton's theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Superposition Theorem.
5. Verification of the Maximum Power Transfer Theorem.
6. Charging and discharging of Capacitor
7. Designing of a Low Pass RC Filter and study of its Frequency Response.
8. Designing of a High Pass RC Filter and study of its Frequency Response.
9. 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.
10. 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.

AEC - 1: Electronics in daily life
Course Code: AECPL01 **Credits = 2 (2+0+0)**

Course Objectives:

- To have knowledge of various semiconductor components and devices
- To know the applications of electronic devices for domestic purposes
- To have knowledge about power semiconductors and control system used in industries and to control various machines and systems
- To have basic knowledge of communication based devices used in daily life

Unit – I: History of Electronics: The vacuum tube era, The semiconductor revolution, Integrated circuits, Compound Semiconductor, Digital electronics Materials, Optoelectronics, Superconducting electronics, Flat-panel displays

Unit – II: Different Electronic Components / Semiconductor Components, Passive Components-Resistors: specifications and colour coding. Capacitors: Principle, specifications and colour coding. Inductors: Principle, specifications and classification, Battery, Battery holders and connectors ,Fuses ,Transistors, Oscillation, thyristors ,Light-emitting diodes (LEDs) AC fundamentals: Generation of alternating voltages, Basic electronic functions Rectification, Amplification Using n-p-n transistor, Multimeters, MOSFETs.

Unit – III: Application of Electronics: Consumer Electronics Office Gadgets like calculators, Personal computers, Digital Camera, FAX machines, Printers, Scanners, Front Projector, etc. Home appliances Robot Vacuum Cleaner, Electric Deep Fryer Refrigerator, AC, Coffee Maker Machine, Hair dryer Water Purifier/Dispenser, Storage Devices
Advanced Consumer Electronic Devices: Smart Phones, iPod and Tablets, Wi-Fi and the Internet, barcode scanners, ATM, Dishwasher and POS terminals.

Medical Electronics: Stethoscope, Respiration Monitors Glucose meter, The Pacemaker, MRI, CT scan
Unit – IV: Industrial and Automotive Electronics: Power Windows, Electronic Control Unit (ECU),Airbag control , all vehicles etc. Meteorological and Oceanographic Electronics: Barometer: .Anemometer: Anemometer Hygrometer ,Data logger Smart Grid Systems Image Processing, Entertainment and Communication Electronics:Smart TVs, Set Top Boxes, Speakers , receivers etc.
Defence Application: RADAR technology, Electronic Warfare Systems, Military electronic equipments etc.

Reference Books:

1. Getting Started in Electronics by Forrest, M.Mims, Master Publishing, Inc
2. Make Electronics – Learning by Discovery by Charles Platt ,Maker Media Publishers
3. Practical Electronics for Inventors , Paul Scherz, McGraw-Hill Education
4. Everyday Electronics and You: A Guide to Maintaining and Getting the Best Out of Your Everyday Electronics Devon A. Smith Kindle Edition ,
5. Complete Guide to Home Appliance Repair – Evan Powel, Better Homes & Garden Books Publication.
6. A Text book of Electrical Technology Vol. 1 and 2,.B.L.Thereja S. Chand & Company
7. Domestic appliances servicing, K.P.Anwer,Scholar Institute Publications.
8. Basic Electrical Engineering, M.L. Anwani,DhanpatRai Publication.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1					1								3		3	1	
CO2	1					1										1	3	
CO3	1					1								3		3		
CO4	1					1											1	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEC - 1: Simulation and Design of Digital Circuit Components
Course Code: SECPL02 **Credits = 1 (1+0+0)**

Course Objectives

- To acquaint students with various basic digital gates used in digital system and develop logical circuits using Boolean gates, construction of various logic circuits using basic gates.
- To impart practical working knowledge of Simulation and Analysis of digital circuits using MATLAB and/or SCILAB.

Learning Outcomes:

On successful Completion of the course, students will be able to:

- Understand the main features and importance of the MATLAB/SCI LAB mathematical programming environment.
- Apply working knowledge of MATLAB/SCI LAB package to simulate and solve Digital Electronics circuits and Applications.

Basics of the circuit components

Basics of Voltage, Current, Resistance and Power, Ohm's law, Series and parallel combinations of electrical components.Basics of electrical instruments such as multimeter, voltmeter and ammeter.

Basics and Applications of the MATLAB

Fundamentals of the MATLAB software. Logic Circuits,Equivalent circuits of an NOT Gate, Exclusive OR Gate, , NOR Gate as Universal Gate, NAND Gate, NAND Gate as Universal Gate, XNOR Gate,Half Adder, Full Adder, Half Adder using NAND Gate, Full Adder using NAND Gate, Comparator.

Reference Books:

1. Electrical Circuits, K.A. Smith and R.E. Alley
2. Modern Digital Electronics by R.P. Jain
3. Digital Electronics by Malvino and Leech
4. Digital Signal Processing with Examples in MATLAB by Samuel D. Strearns and Don R. Hush
5. Digital Signal Processing using MATLAB by Vinay K. Ingle and Johan G. Proakis

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1		1	2			1							1	2				1
CO2		1	2			1							2	2		2		1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SEC - 1: Simulation and Design of Digital Circuits Components Lab
Course Code: SECPL02 **Credits = 1 (0+0+1)**
Name of Experiments

1. Design the OR, AND &NOT Gate circuits using software and Verify with experiments
2. Design the NANDGate circuits using software and Verify with experiments.
3. Design the NOR Gate circuits using software and Verify with experiments.
4. Design the Half Adderusing NAND Gate using software and Verify with experiments.
5. Design the Full Adderusing NAND Gate using software and Verify with experiments.
6. Design the Comparator circuit using software and Verify with experiments.

Semester - II

Core 3: Semiconductor Devices **Credit: 3 (3+0+0)**
Course Code: PLUBTT1
Course Objective:

- This module introduces to the students some of the important semiconductor devices along with the underlying semiconductor physics. The module makes the students familiar with the working principles of major semiconductor diode, bipolar transistor, field-effect transistor devices, negative-resistance and power devices and photonic devices.
- Understand the fundamental principles and applications of modern electronic and optoelectronic semiconductor device.
- Understanding the connection between theory and practical as well as to make familiar with Experiments.

Course Outcomes: After completion of this course, students will be able to

- Get an understanding about the working principles and characteristics of different types of semiconductor devices — p-n junction diodes, bi-polar transistors, MOSFETs, MESFETs, tunnel diodes, photo-detectors, LEDs and solar cells

Unit – I: Semiconductor Basics: Carrier Concentration at Normal Equilibrium in Intrinsic Semiconductors, Fermi Level for Intrinsic & Extrinsic Semiconductors, Donors, Acceptors, Dependence of Fermi Level on Temperature and Doping Concentration, Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect, Diffusion Process, Einstein Relation, Current Density Equation, Continuity Equation.

Unit – II: P-N Junction Diode: Formation of Depletion Layer, Space Charge at a Junction, Derivation of Electrostatic Potential Difference at Thermal Equilibrium, Concept of Linearly Graded and an abrupt Junction, Depletion Width and Depletion Capacitance of an Abrupt 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 – III: Bipolar Junction Transistors (BJT): PNP and NPN Transistors, Basic Transistor Action, Emitter Efficiency, Current Gain, Energy Band Diagram of Transisto rin Thermal Equilibrium, Quantitative Modes of operation, Input and Output Characteristics of CB, CE and CC Configurations. Metal Semiconductor Junctions:

Unit – IV: Field Effect Transistors: JFET, Construction, Idea of Channel Formation, Pinch-Off and Saturation Voltage, Current-Voltage OutputCharacteristics. 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, Characteristics and relaxation oscillator-expression. SCR, Construction, Working and Characteristics, MESFET, Circuit symbols, Basic constructional features, Operation and Applications.

Reference Books:

1) S. M. Sze, Semiconductor Devices: Physics and Technology, 2nd Edition, 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)

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6

CO1		1				1								3		2		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 4: Semiconductor Devices Lab **Credit: 2 (0+0+2)**
Course Code: PLUBLT1
List of Experiments:
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 r_i,r_o,β.
3. Study of the I-V Characteristics of the Common Base Configuration of BJT and obtain r_i, r_o,α.
4. Study of the I-V CharacteristicsoftheCommonCollectorConfigurationofBJTandobtainvoltagegain, r_i, r_o.
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

Core 4: Applied Physics **Credit: 3 (3+0+0)**
Course Code: PLUBTT2
Course Objectives:
- Understand the fundamental principles and applications of modern physics.
- This course covers certain conceptual courses of physics by virtue of which the students will be able to understand some concepts of Quantum Mechanics and solid state behavior.
- It also imparts the basic principles of Quantum mechanics, Thermal Properties, Debye's Law and its applications

Learning Outcomes:
Upon successful completion of this course, students will be able to address following points:
- Understand and explain the differences between classical and quantum mechanics.
- Identify behavior of the solid Materials.

Unit – I: 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 (1dimension),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, Eigen-values and Eigen functions.

Unit – II: 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 – III: 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 – IV: 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, Concepts of Giant Magnetic Resistance (GMR), Magnetic recording.

Reference Books:

1. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
2. Quantum Mechanics: Theory & Applications, A. K. Ghatak & S.Lokanathan, 2004, Macmillan
3. Quantum Mechanics: Concepts and Applications, Wiley Publisher , Nouredine *Zettili*
4. Introduction to Solid State Physics, Charles Kittel, John Wiley & Sons, Inc
5. Material Science and Engineering ,5th Edition , V. Raghavan,

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	1				1								2				
CO2	1	1				1								2				

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 4: Applied Physics Lab **Credit: 2 (0+0+2)**
Course Code: PLUBLT2
Name of the Experiments
1. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
2. To determine the Young's modulus of material of cantilever.
3. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
4. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
5. Determination of Planks constant by Photo electric effect.
6. To determine work function of material of filament of directly heated vacuum diode.
7. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.

Semester – III

Core - 5: Electronic Circuits **Credit: 3 (3+0+0)**
Course Code: PLUCTT1
Course objective:
The course aims to develop an understanding of:
- How to analyze electrical filters, applications of diode diodes, and principle of power supply.
- To learn basic of different transistor biasing.
- To understand basic construction of feedback circuits and their application in Oscillators.
- To understand basic amplifier and oscillator circuits and their application.

Learning outcome:
Upon successful completion of this course, students will be able to address following points:
- Students will the working principle of power supply and it component such as half as well as full wave rectifiers, of regulated power supply.
- Learn the principle of common Emitter based amplifier, class A, Class B
- Students learn the concept of feedback and oscillators such as Phase shift, Colpitt, and Hartley.
- To learn the Biasing of MOSFET and characteristics of FET in common source mode,

Unit – I: Diode Circuits: Ideal diode, 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.

Unit – II: 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 R_E, 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.

Unit – III: 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 – IV: MOSFET Circuits: Review of Depletion and Enhancement MOSFET, Biasing of MOSFETs, Common Source amplifier circuit analysis, CMOS circuits.
Power Amplifiers: Classification of power amplifiers, Class A, Class B, Class C and their comparisons. Operation of a Class A single ended and transformer coupled power amplifier. Circuit operation of complementary symmetry Class B push pulls power amplifier, crossover distortion.

Reference 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)J. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill(2010)
6. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)
7.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1		1				1								3		2		
CO2		1				1								3		2		
CO3		1				1								3		2		
CO4		1				1								3	1	2		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 5: Electronic Circuits Lab **Credit: 2 (0+0+2)**
Course Code: PLUCLT1
Name of Experiments
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/9V DC regulated power supply and find its load-regulation
4. Study of clipping and clamping circuits.
5. Study of Fixed Bias, Voltage divider bias Feedback configuration for transistors.
6. Designing of a Single Stage CE amplifier.
7. Study of the Colpitt's Oscillator.
8. Study of the Hartley's Oscillator.
9. Study of the Phase Shift Oscillator
10. Study of the frequency response of Common Source FET/MOSFET

Core 6: Digital Electronics and VHDL **Credit: 3 (3+0+0)**
Course Code: PLUCLT2
Course Objectives:
- To understand the different number systems and their conversion.
- Design and realization of the basic and universal logic gates and simplification of the Boolean algebra.
- Construction of sequential logic circuits and understanding various design of flip flops.

- To study hardware description languages HDL and describe their role in the electronic design automation environment.
- This course also focuses on basics of VHDL simulation

Learning Outcomes:

Upon successful completion of this course, students will be able to address following points:

- Design and verification of different logic gates (AND, OR, XOR)
- Design of multiplexer, encoder, and decoder circuit using VHDL Design
- Design of arithmetic circuits (half adder, full adder, half subtractor, full subtractor)
- Design of 4 Bit Binary to Grey code Converter using VHDL
- Write simple programs in VHDL in different styles.
- Design and verify the functionality of digital circuit/system using test benches.

Unit – I: Number System: Binary number system, Binary to decimal conversion, Decimal to binary conversion , Binary operations: addition, subtraction, complement of a number - 1's complementary subtraction, 2's complementary subtraction , binary multiplication, binary division, Representation of binary number as electrical signals, octal number system, octal to decimal conversion – decimal to octal conversion, binary to octal conversion, octal to binary conversion, advantages of octal number system, hexadecimal number system, binary to hexadecimal conversion, hexadecimal to binary conversion.

Unit – II: Boolean Algebra: Introduction, Laws of Boolean Algebra, Equivalent switching circuits, De Morgan's theorem, Logic circuits, Definition, Positive and Negative Logic, OR Gate, Equivalent circuit of an OR Gate, AND Gate, Equivalent circuit of an AND Gate, NOT Gate, Equivalent circuit of a NOT Gate, Exclusive OR Gate, Diode OR Gate, Diode AND Gate, Transistor OR Gate, Transistor AND circuit.

Unit – III: Implementation of Combinational Logic Circuits: NOR Gate, NOR Gate as a Universal Gate, NAND Gate, NAND Gate as a Universal Gate, XNOR Gate, Adders and Substractor, Half Adder, Full Adder, Half Substractor, Full Substractor, Half Adder using NAND Gate, Full Adder using NAND Gate, Flip Flop, Master Slave Flip Flop, R-S Flip Flop, Master Slave J-K Flip Flop, Counters, The 7493 A four Bit Binary Counter Shift Register, Serial in – Serial out shift Register

Unit – IV: Introduction to VHDL: A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors, Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements. Highlights of structural Description, Organization of the structural Descriptions, Binding, state Machines, Generate, Generic, and Parameter statements.

Reference Books:

1. Modern Digital Electronics by R.P.Jain
2. Principles of Electronics. V. K. Mehta, Rohit Mehta
3. Digital Computer Electronics: Malvino and Brown
4. Digital Electronics by Malvino and Leech
5. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Second Edition.
6. Kevin Skahill, VHDL for Programmable Logic‖, PHI/Pearson education, 2006.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PSO1	PSO2	PSO3	PSO 4	PSO 5	PSO6
CO1	1	1				1										1		1
CO2	1	1				1							3			1		1
CO3	1	1				1							1			1		1
CO4	1	1				1							3			1		1

CO5	1	1				1							3			1		1
CO6	1	1				1										1		1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 6: Digital Electronics Lab **Credit: 2 (0+0+2)**
Course Code: PLUCLT2
Name of the experiments

1. Realization of Basic logic gates AND, OR, XOR and verify their truth table.
2. Configuring NAND and NOR logic gates as universal gates.
3. Implementation of Boolean Logic Functions using logic gates and combinational circuits.
4. Measure digital logic gate specifications such as propagation delay, noise margin, fan in and fan out.
5. Study and configure of digital circuits such as adder, subtractor,
6. Study and configure of decoder, encoder and code converters.
7. Study and configurations of multiplexer and demultiplexer circuits.
8. Study and configure of flip-flop, registers and counters using digital ICs.
9. Design digital system using these circuits.
10. Perform an experiment which demonstrates function of 4 bit or 8 bit ALU.

Core 7: C/ C++ Programming and Data Structures **Credit: 3 (3+0+0)**
Course Code: PLUCTT3

Course Objectives:
The course aims to develop an understanding of:

- The concept of a program.
- The concept of a loop – that is, a series of statements which is written once but executed repeatedly- and how to use it in a programming language.
- The abstract properties of various data structures such as stacks, queues, lists, and trees.
- Various sorting algorithms, including bubble sort, insertion sort, selection sort, merge sort.

Learning Outcomes:
Upon successful completion of this course, students will be able to address following points:

- To demonstrate an understanding of primitive data types, values, operators and expressions in C.
- Be able to develop logics which will help them to create programs.
- Be able to break a large problem into smaller parts, writing each part as a module or function
- Compare different implementations of data structures and to recognize the advantages and disadvantages of the different implementations.

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

Unit – II: 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 variable, accessing structure members, initializing a structure, copying and comparing structure variables, array of structures, arrays within structures, structures within structures, structures and functions, Pointers.

Unit – III: 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.

Unit – IV: 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.

Reference 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.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO 1	PO 2	PO 3	P O 4	PO 5	P O 6	P O 7	P O 8	PO 9	PO 10	PO1 1	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO6
CO1	1	1												3				
CO2	1	1												3				
CO3	1	1												3				
CO4	1	1												3				

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 7: C/ C++ Programming and Data Structures Lab **Credit: 2 (0+0+2)**
Course Code: PLUCLT3

Name of the experiments

1. Find minimum and maximum of N numbers.
2. Calculate the value of sin (x) and cos (x) using the series. Also print sin (x) and cos (x) value using library function.
3. Generate and print prime numbers up to an integer N.
4. Calculate the subject wise and student wise totals and store them as a part of the structure.
5. Create a stack and perform Pop, Push, Traverse operations on the stack using Linear Linked list.
6. Create circular linked list having information about a college and perform Insertion at front, Deletion at end.
7. Create a Linear Queue using Linked List and implement different operations such as Insert, Delete, and Display the queue elements.
8. Implement Insertion sort and Merge sort.
9. Implementation of Bubble sort and Selection sort.

Semester - IV

Core 8: Signals and Systems **Credit: 5 (4+1+0)**
Course Code: PLUDTT1
Course Objectives :

The course will provide strong foundation on

- Learn basic continuous time and discrete time signals and systems.
- Understand application of various transforms for analysis of signals and systems both continuous time and discrete time.
- Also explore to power and energy signals and spectrum

Learning Outcomes

After learning the course the students should be able:

- To Understand about various types of signals, classify them, analyze them, and perform various operations on them.
- To Understand about various types of systems, classify them, analyze them and understand their response behaviour.
- To illustrate of transforms in analysis of signals and system.

Unit– I: Basic definitions, Classification of signals and systems. Signal operations and properties. Basic continuous time signals and discrete time signals. Basic system properties, Representation for systems Power and energy signals, Energy and power Spectral densities.

Unit– II: Stability of Linear system, Impulse response of Continuous Time Linear Time Invariant system (CT- LTI system, signal responses to CT-LTI system, properties of convolution

Unit– III: Causal signal response to DT-LTI systems. Properties of convolution summation, Impulse response of DT-LTI system. DT-LTI system properties from Impulse response. System analysis from difference equation model, examples.

Unit – IV: Representation of periodic functions, Fourier series& its properties , Frequency spectrum of a periodic signals, Fourier Transform, Relation between Laplace Transform and Fourier Transform and its properties.Fourier Series Sampling theorem and applications, Fast Fourier transform (FFT), Introduction to DTFT and DFT , The z-Transform, Convergence of z-Transform, Basic z-Transform, Properties of z-Transform, Inverse z-Transform .

Reference Books:

1. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall.
2. Signals and Systems by K. Gopalan, Cengage Learning (India Edition).
3. Signals &Systems : Continuous and Discrete by Rodger E. Ziemer , William H.Tranter,D.Ronald Fannin , Pearson Education Asia.
4. Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications.
5. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley- India Publications.
6. Linear Systems and Signals by B.P.Lathi, Oxford University Press.
7. Signal, Systems and Transforms by Charles L. Philips, J. M. Parr and E. A. Riskin, Pearson Education.
8. Digital Signal Processing Fundamentals and Applications by Li Tan, Elsevier, Academic Press.
9. Signal and Systems by Anand Kumar, 3rd Edition, PHI.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	1				2						1			1		2
CO2	2	2	1				2									2		2
CO3	2	2	1				2						2			2		2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 9: Operational Amplifiers and Applications **Credit: 3 (3+0+0)**
Course Code: PLUDTT2
Course Objective:

- To study the characteristics and applications of operational amplifiers (opamps).
- To study op-amp amplifiers, comparators, voltage, and current regulators, summers, integrators, and differentiators as well as a signal generator.
- To study and design multivibrators, various types of filter and their applications.

Course outcome:

- The student will be able to use mathematical and problem-solving approaches for design and Operational amplifiers.
- Be able to define the significance of Op-Amps and their important applications and build circuits using analog ICs.

- Be able to apply depth knowledge of real-time applications such as comparator and trigger circuits.
- Be able to design various types of filers and their applications based on Op Amp.

Unit – I: Basic Operational Amplifier: Concept of differential amplifiers (Dual input balanced and unbalanced output), constant current bias, current mirror, cascaded differential amplifier stages with the concept of the level translator, block diagram of an operational amplifier (IC 741).

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

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

Unit – III: Multivibrators (IC 555): Block diagram, Astable and monostablemultivibrator circuit, Applications of Monostable and Astablemultivibrators, IC565.

Unit – IV: Signal Conditioning circuits: Active filters: First order low pass and high pass Butterworth filter, Second order filters, Band pass filter, Band reject filter, All pass filter.

Reference Books:

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

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3														3			
CO2				2			2						2		3			
CO3			3				2						2		2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 9: Operational Amplifiers and Applications Lab **Credit: 2 (0+0+2)**
Course Code: PLUDLT2
Name of the experiments

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 analog adder and subtractor circuits.
4. Designing an integrator using op-amp for a given specification and studying its frequency response.
5. Designing a differentiator using op-amp for a given specification and studying 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 a band-pass filter using op-amp.
9. Study of IC 555 as an astablemultivibrator.
10. Study of IC 555 as a monostablemultivibrator.

Core - 10: Electronics Instrumentations **Credit: 3 (3+0+0)**
Course Code: PLUDTT3
Course Objectives:

- In-depth understanding of Measurements and errors.

- Students can able to develop topology of the various instruments and apply the knowledge in taking the measurements with better accuracy.
- Students can get knowledge on practice in testing of various instruments and able to take the measurements with better accuracy and precision.

Course outcome:
- The student will be able to use instruments accurately taking care of errors.
- Be able to use sophisticated electronic instruments and knowledge of their basics.
- Be able to compare the results of various instruments.
- Be able to understand the working of Transducers and sensors.

Unit – I: 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.

Unit – II: Basic Measurement Instruments: PMMC instrument, galvanometer, DC measurement-ammeter, voltmeter, ohmmeter, AC measurement, Digital voltmeter systems (integrating and non-integrating types), digital multimeters, digital frequency meter system (different modes and universal counter).
Connectors and Probes: low capacitance probes, high voltage probes, current probes, identifying electronic connectors- audio and video, RF/ Coaxial, USB etc.

Unit – III: Measurement of Resistance and Impedance: Low Resistance: Kelvin's doublebridge 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'sbridge, 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-2 Rladder. A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs for all).

Unit – IV: Transducers and sensors: 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. Measurement of temperature (RTD, thermistor, thermocouple, semiconductor IC sensors), Light transducers (photoresistors, photovoltaiccells, photodiodes).

Reference Books:

1. H.S.Kalsi,ElectronicInstrurnentaion,TMH(2006)
2. W.D.CooperandA.D.Helfrick,ElectronicInstrumentationandMeasurementTechniques,Prentice-Hall(2005).
3. InstrumentationMeasurementand analysis:NakraBC,ChaudryK,TMH
4. E.O.Doebelin,MeasurementSystems:ApplicationandDesign,McGrawHillBook-fifthEdition(2003).
5. JosephJCarr,ElementsofElectronicInstrumentationandMeasurement,PearsonEducation(2005)
6. DavidA.Bell,ElectronicInstrumentationandMeasurements,PrenticeHall(2013).
7. Oliver andCage,"ElectronicMeasurementsandInstrumentation",TMH(2009).
8. AlanS.Morris,"MeasurementandInstrumentation Principles",Elsevier(ButerworthHeinmann-2008).
9. A.KSawhney,ElectricalandElectronicsMeasurementsandInstrumentation,DhanpatRaiandSons(2007).
10. C.S.Rangan,G.R.SarmaandV.S.Mani,InstrumentationDevicesandSystems,TataMcgrawHill(1998).

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6

CO1	3												3					
CO2	3								2	2						3	1	2
CO3	2								2	2						3	1	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 10: Electronics Instrumentations Lab **Credit: 2 (0+0+2)**
Course Code: PLUDLT3
Name of the experiments

1. Designofmultirangeammeterandvoltmeterusinggalvanometer.
2. Measurementof resistancebyWheatstonebridgeandmeasurementofbridgesensitivity.
3. Measure oflowresistancebyKelvin'sdoublebridge.
4. Todetermine theCharacteristicsofresistancetransducer-StrainGauge(MeasurementofStrainusinghalf andfullbridge.)
5. TodeterminetheCharacteristicsof LVDT.
6. Todetermine theCharacteristicsofThermistorsandRTD.
7. Measurementof temperatureby Thermocouplesand study of transducerslike AD590 (two terminaltemperaturesensor),PT-100,J-type,K-type.
8. TostudytheCharacteristicsofLDR,Photodiode,andPhototransistor:
9. VariableIllumination (ii) LinearDisplacement.
10. CharacteristicsofoneSolidStatesensor/Fiber opticsensor

Semester - V

Core 11: ElectromagneticTheory **Credit: 5 (4+1+0)**
Course Code: PLUETT1
Course Objectives:
The course aims to develop an understanding of:

- The basic mathematical concepts related to electromagnetic vector fields
- Knowledge on the concepts of electrostatics, magneto-statistics and its applications
- The concept of Electromagnetic Waves and fundamentals.
- To enhance the ability to Solve Electromagnetic Relation using Maxwell relations

Learning Outcomes:
Upon successful completion of this course, students will be able to address following points:

- Understand the basic mathematical concepts related to electromagnetic vector fields.
- Apply the principles of electrostatics to solve the problems related to electric field and electric potential.
- Apply the principles of magneto-statics to the solutions of problems relating to magnetic field and magnetic potential
- Understand the concepts related to Faraday‘s law, induced emf and Maxwell‘s equations.
- Apply Maxwell‘s equations to solve the problems of boundary conditions, plane wave propagation

Unit – I: Vector Analysis: Scalars and Vectors, Vector Algebra, Vector Components and Unit Vector, Cartesian, Cylindrical and Spherical Coordinates, Line, Surface and Volume integrals, Del Operator, Gradient of a Scalar, Divergence and Curl of a Vector, the Laplacian.Derivation of Poisson’s and Laplace’s equation, Examples of Solution of Laplace’s Equation.

Unit – II: 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, Dielectric materials, Dielectric Constant, Capacitance and Capacitors, Electrostatic Energy.

Unit – III: Magnetostatics and Time-Varying Fields: BiotSavert’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, Magnetic Energy.Faraday’s Law of Electromagnetic Induction,Inductors and Inductances,Transformer and Motional EMF, Stationary Circuit in Time-Varying Magnetic Field.

Unit – IV: Maxwell's Equations and its Applications:, Maxwell's Equations in differential and integral form and Constitutive Relations. Displacement Current, Electromagnetic Boundary Conditions.Scaler and vector magnetic potential,Flow of Electromagnetic Power and Poynting Theorem, PoyntingVector, Wave Equation in a source free isotropic homogeneous media.

Reference 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. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education (2001)
4. J. A. Edminster, Electromagnetics, Schaum Series, Tata McGraw Hill (2006)
5. N. Narayan Rao, Elements of Engineering Electromagnetics, Pearson Education (2006)
6. Introduction to Electrodynamics, D.J. Griffiths, Pearson Education (2012)

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3								3		3	3					
CO2	2				3	1			2				3					
CO3	3															3	2	2
CO4		3										1						2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 12: Microprocessors and Microcontrollers **Credit: 3 (3+0+0)**
Course Code: PLUETT2
Course Objectives:

- Understand the evaluation of microprocessors and microcontrollers and their difference, uses, applications in day to day life.
- Understand the architecture of microprocessor & microcontroller, their internal mechanism how each block is functioning.
- The writing programs in assembly language and able to run by using the microprocessor.
- Learn how to interface the peripheral devices to this microprocessor and microcontrollers.

Unit – I: Introduction to Microprocessor: Introduction, Applications, Basic block diagram, Speed, Word size, Memorycapacity,Classificationofmicroprocessors(mentionofdifferentmicroprocessorsbeingused)
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, pindescriptionofmicroprocessor8085. Basicinterfacingconcepts,MemorymappedI/OandI/OmappedI/O.

Unit – II: 8085 Instructions: Operation code, Operand & Mnemonics. Instruction set of 8085, instruction classification,addressing modes, instruction format. Data transfer instructions, arithmetic instructions, increment & decrementinstructions,logicalinstructions,branchinstructionsandmachinecontrolinstructions.Assemblylanguageprogrammingexamples.
Stack operations, subroutine, call and return instructions. Delay loops, use of counters, timing diagrams-instructioncycle,machinecycle,T-states,timedelay.
Interrupt structure of 8085A microprocessor, processing of vectored and non-vectoredinterrupts,latency time andresponsetime;Handlingmultipleinterrupts

Unit – III: Microcontrollers: Introduction,differenttypesofmicrocontrollers,embeddedmicrocontrollers,processorarchitectures. Harvard vs. Princeton, CISC vs. RISC architectures, microcontroller memory types, microcontrollerfeatures,clocking,I/Opins,interrupts,timers,peripherals.

Unit – IV: PIC16F887 Microcontroller: Core features, Architecture, pin diagram, memory organization- Program and datamemory organization, I/O Ports, oscillator module, Timer modules (Timer 0, Timer 1 and Timer 2), comparatormodule, analog-to-digital converter (ADC) module, data

EEPROM. 16x2 LCD display,4x4Matrix Keyboard, Digital to Analog Converter, Stepper Motor and DC Motor. Interfacing program examples usingC language.

Reference Books:

1. Microprocessor Architecture, Programmingand Applicationswith 8085, Ramesh S.Gaonkar - WileyEasternLimited-IVEdition.
2. FundamentalsofMicroprocessor&Microcomputer:B.Ram-DanpatRai Publications.
3. MicrochipPIC16F87Xdatasheet
4. PICMicrocontrollers,MilanVerle,MikroElektronika,1stedition(2008)
5. Muhammad AliMazidi,"MicroprocessorsandMicrocontrollers",Pearson, 2006

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3							2		2		2	3		3	2		2
CO2	2	2					3								3		3	
CO3								3								3		
CO4								3	3									3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 12: Microprocessors and Microcontrollers Lab **Credit: 2 (0+0+2)**
Course Code: PEUELT2
Name of the experiments

1. Programtotransferablock ofdata.
2. Programformultibyteaddition and subtraction
3. Programtomultiply and division two16-bitnumbers.
4. ProgramtogeneratetermsofFibonacci series.
5. ProgramtofindminimumandmaximumamongNnumbers
6. Programtofindthesquare rootofaninteger.
7. ProgramtofindGCDoftwonumbers.
8. Programtoverifythetruthtableoflogicgates.

PIC Microcontroller Programming, (perform any of 6 programs in 12 lectures)
Note: Programs to be written using C programming language

1. Interfacing of LCD (2Xl6).
2. Interfacing of step permotor and Rotating step per motor by N steps clockwise /anticlockwise withspeedcontrol.
3. Generate sine, square, saw tooth, triangular and staircase wave form using DAC interface.
4. Displayof4-digitdecimalnumberusingthemultiplexed7-segmentdisplayinterface.
5. AnalogtodigitalconversionusinginternalADCanddisplaytheresult onLCD.
6. Speed controlofDCmotorusingPWM(pulsedelaytobeimplementedusingtimers).
7. Interfacingofmatrixkeyboard(4X4).
8. SerialcommunicationbetweenmicrocontrollerandPC.

DSE - 1: Nano Electronics **Credit: 3 (3+0+0)**
Course Code: PLUETD1
Course Objectives:
The course aims to develop an understanding of:

- Explain the various aspects of nano-technology and the processes involved in making nanomaterials.
- Explain confinement of charge carrier on properties of materials
- To provide the knowledge on various nanomaterials synthesis processes.
- To gain the knowledge on characterization of nanomaterials.

Learning Outcomes:
Upon successful completion of this course, students will be able to address following points:

- Learn the basic physics of nanomaterials.

- Learn the various experimental techniques for synthesis of nanomaterials.
- Learn various characterization techniques of nanomaterials.
- Knowledge of the various nanostructure of carbon materials and their applications

Unit – I: Definition of Nano-Science and Nano Technology, Applications of NanoTechnology. Introduction to Physics of Solid State: Size dependence of properties, bonding in atoms and giant molecular solids, 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.

Unit – II: 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. Thermal evaporation technique, E-beam evaporation, Chemical Vapour deposition (CVD), Pulsed Laser Deposition, Molecular beam Epitaxy, Sol-Gel Technique (No chemistry required).

Unit – III: Methods of Measuring Properties and Characterization techniques: Microscopy:Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Infra-red and Raman Spectroscopy, X-ray Spectroscopy, Optical and Vibrational Spectroscopy, Characterization and application like biopolymer tagging and light emitting semiconductor quantum dots.

Unit – IV: 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.

Reference Books:

1. Nanoscale Science and Technology, Robert W. Kelsall, Ian W. Hamley and MarkGeoghegan, 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, WileyInterscience, 2003.
4. Introduction to Nanoscience and Technology K.K. Chattopadhyay and A. N. Banerjee,. (PHI Learning Private Limited)
5. Nano: The Essentials: Understanding Nanoscience and Nanotecnology, T.Pradeep, TataMcGraw-Hill Publishing Company Limited, New Delhi, 2008.
6. Nanobiotechnology, concepts, applications and perspectives, Wiley-VCH, 2004.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3		3										3					
CO2		3																
CO3			2	3												3		
CO4				3	3		3											

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

DSE - 1: Nano ElectronicsLab **Credit: 2 (0+0+2)**

Course Code: PLUELD1

Name of the experiments

1. Synthesis of at least two different sizes of Nickel Oxide/ Copper Oxide/ Zinc Oxide NanoParticles Using Sol- Gel Method.
2. Particle size determination by X-ray diffraction (XRD) and XRD analysis of the givenXRD spectra
3. Determination of the particle size of the given materials using He-Ne LASER.
4. Spectroscopic characterization of metallic, semiconducting and insulating nanoparticles
5. Growth of quantum dots by thermal evaporation.
6. To prepare nanocomposite materials and its characterizations.

DSE - 2: Numerical Techniques **Credit: 3 (3+0+0)**
Course Code: PEUETD2

Course Objectives:
The course aims to develop an understanding of:

- Learning basic methods, tools and techniques of computational physics.
- Include techniques for simple optimization, interpolation, linear algebra underlying systems of equations, ordinary differential equations to simulate systems.
- Developing practical computational problem solving skills in basic computer programming

Learning Outcomes:
Upon successful completion of this course, students will be able to address following points:

- Identify and describe the characteristics of various numerical methods.
- Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations.

Unit – I: Numerical Methods: Round-off error, Programming errors, Solution of Transcendental and Polynomial Equations usingBisection method, Secant, Regula Falsi Methods, Newton Raphson method, Iteration Methods, Newton's Method for Systems.

Unit – II: Interpolation: Langrange Interpolation, Newton Divided Difference Interpolation (forward and backward difference formulae). **Curve Fitting**: Least square fitting, Curve fitting.

Unit – III: Numerical Integration: Trapezoidal Rule, Simpson's Rule and Gauss Integration formula.
Numerical methods for first order differential equations: Taylor's Series, Euler's Method and RungeKutta method.

Unit – IV: Numerical Methods in Linear Algebra: Linear systems $Ax = B$, Gauss Elimination, Partial Pivoting, Matrix Inversion by Gauss-Jordon, Iterative Methods: Gauss-Seidel Iteration, Jacobian Iteration.

Reference books:

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

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2									3	3	2		2		
CO2		3	3	3						2						3		
CO3	2	2					2						3	3				
CO4																		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

DSE - 2: Numerical Techniques Lab **Credit: 2 (0+0+2)**
Course Code: PEUELD2
Name of the experiments
1. Program to implement Bisection Method
2. Program to implement Secant Method
3. Program to implement Regulafalsi 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 RungeKutta Method
8. Program to implement Gauss-Jordon Method
9. Program to implement Gauss-Seidel Iteration

Semester - VI

Core 13: Semiconductor Fabrication & Characterization **Credit: 3 (3+0+0)**
Course Code: PLUFTT1
Course Objectives:
The course aims to develop an understanding of:
- To introduce the fundamental properties and fabrication methods of semiconductor materials used for technology development
- To know the state-of-the-art fabrication techniques of different materials,
- To know the various properties of semiconductor materials used for device fabrication.

Learning Outcomes:
Upon successful completion of this course, students will be able to address following points:
- Understand and discuss the basic fabrication principals of semiconductor materials;
- Apply and select appropriate techniques for characterizing semiconductor materials;
- Demonstrate the basic aspects of advanced engineering of semiconductor materials and their applications in device and system fabrication.

Unit– I:Introduction of Semiconductor Process Technology: Introduction of Semiconductormaterials and Devices,singlecrystal,polycrystalline andamorphous,Crystalgrowthtechniques: Silicon Crystal Growth from the melt, The Czochralski technique, SiliconFloatZoneProcess,GaAs fromBrigdmantechniques. Waferpreparation.

Unit – II: Film Deposition: Epitaxial Growth Techniques, Chemical Vapour Deposition, CVD for GaAs, Metalorganic CVD, Molecular Beam Epitaxy, Defect in Epitaxial layers. Dielectric Deposition
Characterization: Crystal characterization, Crystal defects**,** Characterization methods for structural, opticalproperties. Basic idea of X-ray diffractometer, andUV-VIS-NIRspectrophotometer.

Unit – III: Silicon Oxidation: Thermal OxidationProcess:Kinetics of Growth for thick and thin Oxide, Dryand Wet oxidation. Effects ofhigh pressure and impurityRedistribution duringOxidation, Masking property of Silicon Dioxide, Oxide Quality.

Unit – IV: Etching: WetChemicalEtching-basicprocessandfewexamplesofetchantsforsemiconductors, insulators and conductors; Dry etching using plasma etching technique.**Metallization:** Uses of Physical Vapor Deposition and Chemical Vapor Deposition techniqueforAluminumandCopperMetallization. **LithographicProcesses:**Basic idea about lithography process

Reference books:

1. GaryS. MayandS. M. Sze,FundamentalsofSemiconductorFabrication,JohnWiley&Sons (2004)
2. LudmilaEckenova,PhysicsofThinfilms,Second Edition,PlenumPress(1986).

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3		2				1							2	1	3	2	
CO2		3												1		3		1
CO3		3												1		3		1
CO4																		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 13: Semiconductor Materials Lab **Credit: 2 (0+0+2)**

Course Code: PLUFLT1

Name of the experiments

1. To measuretheresistivityof semiconductorcrystal withtemperaturebyfour -probemethod.
2. To determine the type (n orp) and mobility of semiconductormaterialusingHall-Effect System
3. To determine the thickness of Thin films using Ellipsometer
4. To determine the Energy Band gap (Eg) of silicon Crystal using energy band gap measurement setup
5. To Characterize the optical characteristics using UV-VIS Spectrometer
6. To find out the chemical bond present in deposited thin films using FTIR
7. To Synthesize the Thin Films using Sol-Gel Spin Coating system
8. To Synthesize the Thin Films using Chemical Route Synthesis method
9. To Deposit the Thin Films of Conductors using CVD System
10. To Determine the OpticalBandgapthroughtransmissionspectra.

Core 14: Communication Electronics **Credit: 3 (3+0+0)**

Course Code: PLUFTT2

Course Objectives: The course aims to develop an understanding of:

- The objective of this syllabus is to impart primitive to advance theoretical and practical knowledge of communication technology,
- To understand special emphasis on modulation techniques to learners.
- This includes both analog and digital modulation and this knowledge will serve as building block in understanding advance communication system.

Learning Outcomes:

Upon successful completion of this course, students will be able to address following points:

- Basic concept of communication technology.
- Processes involved in communication..
- Then they will be accustomed to both analog and digital modulation techniques in both theoretical and practical aspects.

Unit – I: Electronic communication: Block diagram of an electronic communication system,
need for modulation, concept of channels and base-band signals. Concept of Noise,Types of Noise, Signal to noise ratio, Noise Figure, Noise Temperature.

Unit – II: 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

Angle modulation: Frequency and Phase modulation, modulation index and frequency spectrum, Block diagram of FM Transmitter and Receiver .Comparison between AM, FM and PM.

Unit – III:Pulse Analog Modulation: Sampling theorem, Multiplexing, TDM and FDM.

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

Unit – IV:Digital Carrier Modulation Techniques: 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)

Reference Books:

1. Electronic communication systems-Kennedy,3rd edition,McGrawinternationalpublications
2. Principles of Electronic communication systems–Frenzel,3rd edition,McGrawHill
3. Communication Systems, S.Haykin, WileyIndia(2006)

4. Advancedelectroniccommunicationssystems–Tomasi,6th edition,PHI.
5. CommunicationSystems,S.Haykin,WileyIndia(2006)

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3				1		2	1					3	2	1	1		
CO2			3														2	2
CO3	3												3	1		2	1	
CO4																		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Core 14: Communication Electronics Lab **Credit: 2 (0+0+2)**
Course Code: PLUFLT2
Name of the experiments
1.Study of Amplitude Modulation and Demodulation
2.Study of Frequency Modulation and Demodulation
3.Study of Pulse Amplitude Modulation
4.AM Transmitter/Receiver
5.FM Transmitter/Receiver
6.Study of TDM, FDM
7.Study of Pulse Width Modulation
8.Study of Pulse Position Modulation
9.Study of Pulse Code Modulation
10.Study of Amplitude Shift Keying
11.Study of Phase Shift Keying,
12.Study of Frequency Shift Keying.

DSE 3: Photonic Devices and Power Electronics **Credit: 3 (3+0+0)**
Course Code: PLUFTD1
Course Objectives:
The course aims to develop an understanding of:

- Wide variety of different semiconductor optoelectronic devices employed in light wave systems and networks
- The basic physics behind optoelectronic devices, power semiconductor devices and passive components and their practical applications in power electronics
- The structure of power electronic devices such as diode, SCR, IGBT, MOSFET

Learning Outcomes:
Upon successful completion of this course, students will be able to address following points:

- Relate basic semiconductor physics to properties of power devices
- Develop basic understanding of optoelectronic integrated circuits
- Describe basic operation and compare performance of various power semiconductor devices, passive components and switching circuits

Unit – I: Classification of photonic devices. Interaction of radiation and matter, Radiative transition and optical absorption. Light Emitting Diodes- Construction, materials and operation. Semiconductor Laser- Condition for amplification, laser cavity. Charge carrier and photon confinement, line shape function.
Photodetectors: Photoconductor. Photodiodes (p-i-n) and Photo transistors, Photomultiplier tube, Solar Cell: Construction, working and characteristics.

Unit – II: LCD Displays: Types of liquid crystals, Principle of Liquid Crystal Displays, advantages over LED displays. Introduction to Fiber Optics: Evolution of fiber optic system- Element of an Optical Fiber Transmission link, Optical Fiber Modes and Configurations - Mode theory of Circular Wave guides, Single Mode Fibers, Graded Index fiber structure.

Unit – III: Introduction to family of thyristors. Silicon Controlled Rectifier (SCR)- structure, I-V characteristics, Turn-On and Turn-Off characteristics, Diac Basic structure, working and V-I characteristics, Triac- Basic structure, working and V-I characteristics, MOSFET.

Insulated Gate Bipolar Transistors (IGBT): Basic structure, I-V Characteristics, switching characteristics, device limitations and safe operating area (SOA).

Unit – IV: Applications of SCR: Phase controlled rectification, AC voltage control using SCR and Triac as a switch. Power Invertors- Need for commutating circuits and their various types, Parallel capacitor commutated invertors, Series Invertor.

Reference Books:

1. J. Wilson & J.F.B. Hawkes, Optoelectronics: An Introduct ion, Prentice Hall India (1996).
2. S.O. Kasap, Optoelectronics & Photonics, Pearson Education (2009).
3. AK Ghatak& K Thyagarajan, Introduction to fiber optics, Cambridge Univ. Press (1998).
4. Power Electronics, P.C. Sen, Tata McGraw Hill.
5. Power Electronics, M.D. Singh &K.B. Khanchandani, Tata McGraw Hill.
6. Power Electronics Circuits, Devices & Applications, 3rd Edn., M.H. Rashid, Pearson Education.
7. Optoelectronic Devices and Systems, Gupta, 2nd edn., PHI learning.
8. Electronic Devices and Circuits, David A. Bell, 2015, Oxford University Press.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3		1				1					1	3			1	1	
CO2			3				2	1				1		1		2	1	1
CO3			3					1				1		1	1	2	1	1
CO4																		

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

DSE 3: Photonics Devices and Power Electronics Lab **Credit: 2 (0+0+2)**

Course Code: PLUFLD1

Name of the experiments

1. Diffraction experiments using a laser.
2. To determine characteristics of (a) LED and (b) Photo diode.
3. To study the Characteristics of LDR and Photodiode with (i) Variable Illumination intensity, and (ii) Linear Displacement of source.
4. To measure the numerical aperture of an optical Fibre.
5. Output and transfer characteristics of a power MOSFET.
6. Study of I-V characteristics of SCR.
7. SCR as a half wave R and R_L loads.
8. SCR as full wave rectifiers withR and R_L loads.
9. Study of solar cell characteristics.
10. Study of DIAC characteristics.