Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2021-22	
School	: *School of Physical Sciences*
Department	: *Pure and Applied Physics*
Date and Time	: *March 10, 2022 – 02:00 PM*
Venue	: *Smart Class Room*

The scheduled meeting of member of Board of Studies (BoS) of Department of Pure and Applied Physics, School of Studies of Physical Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, was held to design and discuss the M. Sc. (Electronics), scheme and syllabi.

The following members were present in the meeting:

1. Dr. M. N. Tripathi
2. Prof. P. K. Bajpai
3. Prof. D. C. Gupta, External Member (Professor & Head, School of Studies in Physics, Jiwaji University, Gwalior)
4. Dr. A. K. Singh
5. Mr. P. Rambabu
6. Dr. R. P. Patel
7. Dr. M. P. Sharma

The committee discussed and approved the scheme and syllabi. The following courses were revised in the M. Sc. (Electronics):

- Semiconductors Materials & Devices
- Analog and Digital Electronics
- Electromagnetic theory and Wave Propagation
- Advanced Communication System-1

The following new courses were introduced in the M. Sc. (Electronics):

- Mathematical Techniques for Electronics
- Semiconductors Materials & Devices Lab
- Analog and Digital Electronics Lab
- Applications of Nanotechnology in Electronics
- Applications of Nanotechnology in Electronics Lab
- IC Fabrication and VLSI Technology
- Microprocessors and Microcontrollers
- Microprocessors and Microcontrollers Lab
- Analog and Digital Communication System Lab

MNTripathi
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Signature & Seal of HoD

DEPARTMENT OF PURE AND APPLIED PHYSICS

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

Academic year 2021 – 2022

Sem	Course Opted	Course Code	Name of the course	Credit	L:T:P	Internal	External	Total
I	Core-1	PEPATT1	Mathematical Techniques for Electronics	5	4+1+0	30	70	100
	Core -2	PEPATT2	Semiconductors Materials & Devices	3	3+0+0	30	70	100
		PEPALT2	Semiconductors Materials & Devices Lab	2	0+0+2	30	70	100
	Core -3	PEPATT3	Analog and Digital Electronics	3	3+0+0	30	70	100
		PPPALT3	Analog and Digital Electronics Lab	2	0+0+2	30	70	100
	Open Elective		Opted from the pool and offered by other departments	5	5+0+0	30	70	100
	Other if any*							
			TOTAL	**20**				**600**
		Open Elective offered by the Department						
	Open Elective	OPNPET1	Applications of Nanotechnology in Electronics	3	3+0+0	30	70	100
		OPNPEL1	Applications of Nanotechnology in Electronics Lab	2	0+0+2	30	70	100
II	Core-4	PEPBTT1	Electromagnetic theory and Wave Propagation	5	4+1+0	30	70	100
	Core -5	PEPBTT2	IC Fabrication and VLSI Technology	5	4+1+0	30	70	100
	Core -6	PEPBTT3	Microprocessors and Microcontrollers	3	3+0+0	30	70	100
		PEPBLT3	Microprocessors and Microcontrollers Lab	2	0+0+2	30	70	100
	Discipline Specific Elective 1	PEPBTD1	Advanced Communication System-1	3	3+0+0	30	70	100
		PEPBLD1	Analog and Digital Communication System Lab	2	0+0+2	30	70	100
	Other if any*							
			TOTAL	**20**				**900**
III	Core-7	PEPCTT1	Power Semiconductor Devices and Control System	5	4+1+0	30	70	100
	Core-8	PEPCTT2	Sensors and Transducers	5	4+1+0	30	70	100
	Core-9	PEPCTT3	Optoelectronics Devices	3	3+0+0	30	70	100
		PEPCLT3	Optoelectronics Devices Lab	2	0+0+2	30	70	100
	Research Methodology	PEPCTR1#	Research Methodology in Electronics	2	2+0+0	30	70	100
	Discipline Specific elective 2	PEPCTD1	Advanced Communication System-2	3	3+0+0	30	70	100
		PEPCLD1	Advanced Communication System-2 Lab	2	0+0+2	30	70	100
	*Certificate/ FC/UEC			2		30	70	100
	Other if any							
			TOTAL	**22+2***				**700**
IV	Major Project Work With Dissertation	PEPDD01#	Major Project Work With Dissertation	12		30	70	100
	Industrial Training (Internship)	PEPDE01#	Industrial Training in the fields Related to the Programme with Project Report	08		30	70	100
			TOTAL	**20**				**200**

#The Code generated by the Department.

L=Lecture, T= Tutorial, P = Practical (Lab)

* Additional Credit courses (not mandatory in nature)

The Discipline specific courses will be treated as special paper of old pattern as and when needed.

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DEPARTMENT OF PURE AND APPLIED PHYSICS

M.Sc. (Electronics) Course Syllabus under CBCS/LOCF

Academic year 2021 – 22

Semester - I

Core -1: Mathematical Techniques for Electronics
Course Code: PEPATT1
Credits = 5 (4+1+0)

Course Objectives:

- Create deep interest in learning mathematics techniques.
- To offer a gentle introduction to the concepts of Laplace transforms, Inverse Laplace transforms, solution of ordinary differential equations using Laplace transform, Fourier series and their properties with applications in real life.

Course outcomes:

The student after undergoing this course will be able to:

- Analyze, identify and solve the problem using Laplace Series.
- Analyze, identify and solve the problems using Fourier Series
- Apply -Transforms, Inverse Z-Transforms and solve Difference Equations.
- To apply the application of Mathematics in Electronics.

Unit I: Laplace Transform: Definition and Properties, Laplace Transform derivatives and integrals, Evaluation of differential equations using Inverse Laplace Transform, Applications of Laplace Transform , Fourier Series & Transform: Definition and Properties, Fourier series in the Interval, Uses of Fourier Series,Fourier sine and cosine transform of Derivatives, Finite Fourier Transform,
and Applications of Fourier Transform.

Unit II: Partial differential equations: Homogeneous and non-homogeneous boundary conditions, Solutions by separation of variables and series expansion methods. Laplace, wave and diffusion equations in various coordinate systems. Integral equations: methods and solutions,

Unit III: Mathematical Transforms: Discrete time signal analysis and linear systems , Sampling theorem and applications , Sampling of continuous time signals. z-transform, inverse z-transform, Digital Filters: signal flow graph representation, basic structures for IIR and FIR filters, noise in digital filters, filter design techniques, Transforms: Discrete Fourier Transform (DFT) , properties and Fast Fourier Transforms (FFT)

Unit IV: Mathematical tool for Electrical circuits; Superposition, Thevenin, Norton and Maximum Power Transfer Theorems, Network elements, Network graphs, Nodal and Mesh analysisTime and frequency domain response, Passive filters, Two-port Network Parameters : Z, Y, ABCD and h parameters, Transfer functions, Signal representation, State variable method of circuit analysis, AC circuit analysis, Transient analysis, Zero and Poles, Bode Plots.

Reference Books:

1. Advanced Engineering Mathematics : E Kreyszig (John Wiley & Sons)
2. Higher Engineering Mathematics : Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics: H. K. Das, S.Chand&company Ltd.
4. Theory and Application of Digital Signal Processing: L. R. Rabiner and B. Gold, Prentice Hall.
5. Introduction to Digital Signal Processing: J.R. Johnson, Prentice Hall.
6. Industrial Control Electronics – Applications and Design, Michael Jacob Prentice Hall

Core -2: Semiconductor Materials and Devices
Course Code: PEPATT2
Credits = 3 (3+0+0)

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Course Objectives

- To provide basic knowledge and concepts of Semiconductor materials and devices.

- It provides a basic background for advanced courses in electronics, optoelectronics and VLSI design.
- To give an appreciation of the role of the physicist in shaping future electronics
- To provide overview of modern low dimensional semiconductor physics.

Course Outcomes

On completion of the course a student will be able to

- Apply basic concepts of semiconducting materials for electronic device applications.
- Understand major properties of semiconducting materials, explain energy band diagrams and connections with the device structures and properties.
- Holistic view of the latest progress in low-dimensional nano materials for electronic devices.

Unit – I: Introduction to Semiconductor, energy bands in solids, concept of effective mass, density of states, Fermi levels. Extrinsic semiconductors: n and p type doping, Densities of carriers in extrinsic semiconductors and their temperature dependence,

Unit – II: Carrier transport, Conductivity, Mobility and Hall Effect, Diffusion and drift of excess carriers, recombination mechanism, Trapping, Continuity Equation, Diffusion Length.

Unit – III: PN Junction, Diode equation and diode equivalent circuit, Breakdown in diodes, Zener diode, Tunnel diode, Metal semiconductor junction – Ohmic and Schottky contacts, Characteristics and equivalent circuits of JFET, MOSFET.

Unit – IV: Low dimensional semiconductor devices – quantum wells, quantum wires, quantum dots. High Electron Mobility Transistor (HEMT), Solar cells – I-V characteristics, fill factor and efficiency, LED, LCD and flexible display devices. Emerging materials for future Devices: Graphene, Carbon Nano tubes (CNT), ZnO, SiC etc.

Reference Books:

1. Physics of semiconductor Devices, S. M. Sze.
2. Semiconductor Devices, ISBN 0-471-36245-X, Jaspreet Singh,
3. Principles of electronic materials and devices, ISBN 0-07-295791-3, S. O. Kasap,
4. The Physics of Low Dimensional Semiconductors (J H Davies, Cambridge)
5. Physics of Semiconductors and their Heterostructures (J Singh, Wiley)
6. Electronic and Optical Properties of Semiconductor Structures (J Singh) Cambridge)
7. Quantum Wells, Wires and Dots, (P Harrison, Wiley)
8. Low Dimensional Semiconductors (M J Kelly Oxford)
9. Solid state Electron Devices-B. G. Streetman.
10. Semiconductor Physics and Device – Neamen, McGraw Hill

Core -2: Semiconductor Materials and Devices Lab
Course Code: PEPALT2
Credits = 2 (0+0+2)

Name of the experiments

1. Measurement of resistivity of sample at various temperatures by four probe method.
2. To calculate the energy band gap of given semiconductor sample.
3. To study the Hall Effect: determine the Hall coefficient, type of semiconductor and carrier concentration in the given semiconductor sample
4. I-V characteristics measurement of a p-n diode/Schottky diode calculate its device Parameters.
5. To study the performance of solar cell.
6. To study characteristics of JFET and its application as switch.
7. To study characteristics of MOSFET and its application.

Core - 3: Analog and Digital Electronics
Course Code: PEPATT3
Credits = 3 (3+0+0)

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Course Objectives:

- To study rectifiers, ICs based regulated power supply, Transistor Biasing, FETs, operating point and stability, Amplifiers, and Various types of oscillators.
- To study the basic principles, configurations and practical limitations of op-amp. , to understand the various linear, non-linear applications of op-amp and frequency generators.
- To analyze, design and explain the characteristics and applications of active filters, and to analyze different types of Multi vibrators and their design procedures.
- To understand simplification of boolean algebra by Minimization techniques (Karnaugh maps and Quine-McCluskey),
- To analyze logic process and implement logical operation using combinational and sequential logic circuit, mixed logic combinational circuits, multiple output functions
- To understand characteristics of flip-flops, Counters Registers A/D and D/A Convertor, memory and their classifications.

Learning Outcomes:

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

- This course provides the foundation inrectifiers, ICs based regulated power supply, transistor biasing, amplifiers, and various types of oscillators.
- Able to understanding in operational amplifier and other linear integrated circuits, the op-amp's basic construction, characteristics, parameter limitations, various configurations of opamp,non-linear circuits, active filters and signal generators.
- Able to Analyze and design multivibrators, develop a digital logic and apply it to solve real life problems.
- Able to analyze design and implements combinational and sequential logic circuits.
- Able understanding and implementation of flip-flops, Counters, Registers, A/D and D/A Convertor, memory.

Unit – I: Rectifiers, Voltage regulated ICs and regulated power supply, Biasing of Bipolar junction transistors andFETs, operating point and stability, Amplifiers, Classification of amplifiers, Concept of feedback,Hartley, Colpitt's and Phase Shift oscillators.

Unit – II: Operational amplifiers (OPAMP) - characteristics, computational applications, comparators, Schmitt trigger, Instrumentation amplifiers, wave shaping circuits, Phase locked loops, Active filters, multivibrators, Voltage to frequency convertors (V/F), frequency to voltage convertors (F/V).

Unit – III: Combinational circuits : Logic Families, Logic Gates, Boolean algebra , minimization techniques :Switching equations, canonical logic forms, sum of product & product of sums, Karnaugh maps, two, three and four variableKarnaugh maps, simplification of expressions, Quine-McCluskeyminimization technique, mixed logic combinational circuits, multipleoutputfunctions.Sequential circuits: multiplexers and demultiplexers.

Unit – IV: Flip-flops, clocked and edge triggeredflipflops, Counters – Ring, Ripple, asynchronous and synchronous counters, counter design with state equations, Registers , serial in serial out shift registers, tristateregistor, timing considerations. A/D and D/AConverter, Sequential PLD, FPGA, Analysis and Design of digital circuits using HDL, Programmable Logic Devices (PLD), flip flops memories.

Reference Books:

1. Millman's Integrated Electronics - Analog and Digital Circuit and Systems.
2. A.P. Malvino, Electronic Principles, Tata Mcgraw Hill Publications.
3. Robert L. Boylestad& Louis Nashelsky, Electronic Devices & Circuit Theory.
4. Analysis and Design of Analog Integrated Circuits by Kenneth Martin Chan Carusone, David Johns
5. Digit al Principles &Application: Malvino& Leach.
6. Computer System Architecture: Moris Mano.
7. Digit al Electronic: Schaum Series.
8. Digit al Electronics: R.J.Tossi (PHI).
9. Digit al electronics: R.P. Jain.

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Core - 3: Analog and Digital Electronics Lab
Course Code: PEPALT3
Credits = 2 (0+0+2)

Name of the experiments

1. Design some combinational circuits using NAND & NOR Gate.
2. Design circuit Using IC 7400 and 7402 to verify.
3. Study characteristics of FET and MOSFET.
4. Study characteristics of Colpit's oscillator.
5. Experiment based on Operational Amplifier (like adder, subtractor and Others)
6. To Study the characteristics of op- amp as Inverting and non inverting.
7. To Study the characteristics of op- amp as Schmitt trigger & Comprator.
8. Study and designs flip flop.
9. Study and designs of A/D & D/A Convertor.

References:

1. Millman's Integrated Electronics - Analog and Digital Circuit and Systems.
2. Digit al Principles & Application: Malvino& Leach.
3. Digit al electronics: R.P. Jain.

Open Elective: Applications of Nanotechnology in Electronics
Course Code: OPNPET1
Credits = 3 (3+0+0)

Course Objectives

- Foundation knowledge of the nanoscience field
- To bring out the distinct properties such as electronic, optical properties of nanostructures
- To make the students acquire an understanding the nanomaterials and their applications

Learning Outcomes

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

- Learn about the distinct properties of nanomaterials
- Understand the principles of nanomaterial characterization techniques
- Describe the principle and operation of nanomaterial-based devices

Unit – I: Definition of Nano-science and nano technology, History of nanoscience, Energy band-gap in semiconductors, Fermi level, Donors, acceptors and deep traps, Excitons, Mobility, Conduction electrons, density of states, Zero dimensional (0D), one dimensional (1D) , two dimensional (2D) , three dimensional (3D), Nano-structured materials, Influence of nano over micro/macro.

Unit – II: Properties of Nanomaterials: Size dependence of properties, Optical: Absorption, transmission, Photoluminiscence, Fluoroscence, Phosphorescence, Surface Plasmon Resonance, effect of size of nano particles. Electrical: Conduction mechanisms in 3D (Bulk), 2D (Thin film) and Low dimensional systems.

Unit – III: Type of Nanomaterials: different type of nano materials,Carbon nanotube, Fullerene, Type of CNT: SWNT (Single wall nano tube), Multi wall nano tubes, Graphite and Graphene, metal nano particle silver and gold, ZnO and TiO_2 metal oxides, Semiconductors, Nano-composites,Creating nanoparticles by using software.

Unit – IV: Synthesis of nanomaterials: Combustion method, Sol-gel method, Co-precipitation method. Characterization tools for nanomaterials: X-Ray Diffraction, UV-VIS Spectrophotometer, Spectrofluorophotometer, Scanning Electron Microscopy, Transmission Electron Microscopy.

Reference Books:

1. Introduction to Nanotechnology, Charles P. Poole, Jr., Frank J. Owens, Wiley India (P)Limited New Delhi.

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2. Nanoscience and Nanotechnology, K.K. Chattopadhyay, A.N. Banerjee, PHI Learning Private Limited, New Delhi.
3. Understanding of Nano Science and Technology, PoorviDutta, Sushmita Gupta, Global Vision Publishing House, New Delhi.
4. Nanotechnology, WM Breck, CBS Publishers & Distributors Pvt Ltd, New Delhi.
5. Optical Imaging and Microscopy (Techniques and Advanced Systems), Peter Török, Fu-Jen Kao, Springer Publication.

Open Elective: Applications of Nanotechnology in Electronics Lab
Course Code: OPNPEL1
Credits = 2 (0+0+2)

Name of the experiments

1. To calculate the energy bandgap of nanoparticle from UV-VIS spectra.
2. To measure the average crystallite size using XRD data of a given nanomaterial.
3. Estimation of lattice strain in nanoparticle by XRD pattern.
4. To calculate the grain size of a material fromSEM micrograph.
5. To analyse the absorption and emission spectrum of a given material.
6. Synthesis of nanomaterial by combustion method.

Semester – II

Core-4: Electromagnetic Theory and Wave Propagation
Course Code: PLPBTT1
Credit: 5 (4+1+0)

Course Objectives:
The course aims to develop

- Ability to understand the propagation of electromagnetic waves in different medium
- Understanding of the Gauge transformation and invariance of the fields
- Mathematical analysis of the sinusoidal linear waves
- Ability to understand the physics involved in the waveguides and resonators
- Understanding of the optical fiber communication

Learning Outcomes:
At the end of this course student will demonstrate the ability to:

- Apply the maxwell's equation to explain the propagation of electromagnetic waves in different medium and their related phenomenon such as skin depth etc.
- Understand the concept of Lorentz and Coulomb Gauge.
- Interpret the natural optical phenomenon by using the concept of transverse nature of electromagnetic waves
- Understand the principles involved in the optical fiber communication

Unit – I: Maxwell's equation in terms of scalar and vector potential, Gauge Transformation, Lorentz and Coulomb Gauge, Retarded potential, Electromagnetic waves in free space, wave propagation in linear medium, propagation of sinusoidal voltages, complex analysis of sinusoidal waves and phasor.

Unit – II: Propagation of electromagnetic waves in isotropic dielectric medium. Propagation of em waves in anisotropic dielectric medium, Fresnel law of normal velocities, propagation of em waves in conducting medium, skin depth, Poynting vector in conducting medium, propagation of em waves in ionized gases, plasma frequency.

Unit – III: Interaction of electromagnetic waves with matter, Fresnel Formulae, Snell's law, Brewster's law, total internal reflection, Production of elliptically and circularly lights. Metallic reflection, Rectangular wave guide, TE mode, TM mode. Cavity resonators-TE and TM mode.

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Unit – IV: Wave propagation in the wave guide, Power transmission and attenuation, waveguide current and mode excitation, Optical Fiber, Optical fiber transmission modes, Losses in fiber, measurement of fiber characteristics, introduction to fiber optical communication system.

Reference Books:
1. Principles of Electromagnetics by M.N.O. Sadiku and S.V. Kulkarni
2. Engineering electromagnetic by Hayt and Buck
3. Introduction to electrodynamics by David J. Griffiths
4. Optoelectronics an introduction by J. Wilson and J.F.B. Hawkes
5. Electromagnetics by B. B.Laud
6. Introduction to Electromagnetic theory by T. L. Chow
7. Electromagnetics by Schaum Series

Core -5: IC Fabrication and VLSI Technology
Course Code: PEPBTT2
Credit: 5 (4+1+0)

Course Objectives:
The course aims to develop an understanding of:
- Know the physics of semiconductor junctions, metal-semiconductor junctions and metal-insulator-semiconductor junctions.
- Know the physics and application of semiconductor hetero junctions and quantum-confined structures.
- Understand the fundamental principles and applications of modern electronic and optoelectronic semiconductor devices

Learning Outcomes:
Upon successful completion of this course, students will be able to address following points:
- To get understanding of device fabrication methods
- Understands the VLSI technology
- Understanding the IC Technology

Unit – I: Clean room technology - Clean room concept – Growth of single crystal Si , surface contamination, cleaning & etching. (Laboratory Practices : Cleaning of p-type & n-type Si-wafer by solvent method & RCA cleaning) Oxidation – Growth mechanism and kinetic oxidation, oxidation techniques and systems, oxide properties, oxide induced defects, charactrisation of oxide films, Use of thermal oxide and CVD oxide; growth and properties of dry and wet oxide, dopant distribution, oxide quality; (Laboratory Practices : Fabrication of MOS capacitor)

Unit – II: Solid State Diffusion – Fick's equation, atomic diffusion mechanisms, measurement techniques, diffusion in polysilicon and silicon di-oxide diffusion systems. Ion implantation – Range theory, Equipments, annealing, shallow junction, high energy implementation. Lithography – Optical lithography, Some Advanced lithographic techniques. Physical Vapour Deposition – APCVD, Plasma CVD, MOCVD. Metallisation - Different types of metallisation, uses & desired properties. VLSI Process integration.

Unit – III: Materials For Integrated Circuits and Fabrication Technology: Classification of IC's, Electronic grade silicon, Silicon shaping lapping polishing and wafer preparation, Vapour phase epitaxy, Molecular beam epitaxy, Optical lithography, Photomask, Photoresist and process, Limitation of optical Lithography, Idea of electron and X-ray Lithography, Wet chemical etching, reactive plasma etching.

Unit – IV: Microelectronic Fabrication: Fabrication of mono lithic diodes, Fabrication of integrated transistors, idea of burried layer fabrication, Monolithic circuit layout and design rule, Isolation methods, Monolithic FET, MOSFET, Processing idea of HEMT (High Electron Mobility transistor), CCD, MOS integrated circuit, Large and medium scale integrated, Hybrid Integrated circuit.

Reference Books:
1. Integrated Electronics : Milliman and Taub

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2. Microelectronics : Milliman and Gros
3. Thin film Phenomenon : K.L. Chopra
4. Hand Books Of Thin Film : Marshe l and Gland
5. Physics of Semiconductor devices : Michel Shur
6. IC Fabrication : J. A. Ellcott
7. Semiconductor Devices Physics and Technology, Author: Sze, S.M.; Notes: Wiley, 1985
8. An Introduction to Semiconductor Microtechnology, Author: Morgan, D.V., and Board, K
9. The National Technology Roadmap for Semiconductors , Notes: Semiconductors Industry Association, SIA, 1994
10. Electrical and Electronic Engineering Series VLSI Technology, Author: Sze, S.M. Notes: McgrawHill International Editions

Core -6: Microprocessors and Microcontrollers
Course Code: PEPBTT3
Credit: 3 (3+0+0)

Course Objectives:
The course aims to develop an understanding of:
- The difference between microprocessor and microcontrollers
- Their architecture including designed, memory organizing, addressing modes, timing
- Data moving and transferring
-

Learning Outcomes:
After completion of this syllabus, students are able to understand:
- The difference between microprocessor and microcontrollers and their architecture.
- To write the programs and load the data on registers and perform the arithmetic and logical operations.

Unit – I: 8086 Architecture and Programming: 8086 Architecture – Min.Mode, Max.Mode – Software Model – Segmentation – Segmentation of address – Pipe line Processing. Addressing Modes – Instruction Set- Constructing Machine Code – Instruction Templates for MOV Instruction– Data Transfer Instructions– Arithmetic, Logic, Shift, rotate instructions Flag Control instructions- Compare, Jump Instructions– Loop and String instructions -Assembly programs- Block move, Sorting, Averaging, Factorial – Code Conversion : Binary to BCD, BCD to Binary.

Unit – II: 8051 Microcontroller Hardware Introduction – Features of 8051 – 8051 Microcontroller Hardware : Pin-out of 8051, Central Processing Unit (CPU), Internal RAM, Internal ROM, Register set of 8051 – Memory organization of 8051 – Input / Output pins, Ports and Circuits – External data memory and Program memory : External program memory, External data memory.

Unit – III: 8051 Instruction Set And Assembly Language Programming Addressing modes – Data moving (Data transfer) instructions : Instructions to Access external data memory, external ROM / program memory, PUSH and POP instructions, Data exchange instructions – Logical instructions : byte and bit level logical operations, Rotate and swap operations – Arithmetic instructions : Flags, Incrementing and decrementing, Addition, Subtraction, Multiplication and division, Decimal arithmetic – Jump and CALL instructions : Jump and Call program range, Jump, CALL and subroutines – Programming.

Unit – IV: Interfacing to External World Interfacing keyboard: Simple keyboard interface, Matrix keyboard interface – Interfacing displays: Interfacing seven segment LED displays, Interfacing LCD display – Interfacing DAC to 8051– Interfacing ADC to 8051 – Interfacing sensors – Interfacing stepper motor.

REFERENCE BOOKS:
1. A. P. Godse and D. A. Godse, “Microprocessors & its Applications”, Technical Publications, Pune,
2. Kenneth Ayala, “The 8051 Microcontroller”, Third Edition, Delmar Cengage Learning, 2005.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.McKinlay, “The 8051 Microcontroller and Embedded Systems”, Second Edition, Pearson Education 2008.

4. W.A. Triebel and Avatar Singh, The 8086 /8088 Microprocessors- Programming, Software, Hardware and application, Prentice Hall of India, New Delhi.
5. Douglas V. Hall : - Microprocessors and Interfacing programming and Hardware (Tata Mc Graw Hill) (Unit 1)
6. B. Brey, 1995, Intel Microprocessors 8086/8088, 80186,80286,80486,80486, Architecture, Programming and Interfacing
7. Yu – Cheng and Glenn A. Gibson, The 8086 / 8088 family Architecture, Programming and Design, Prentice-Hall of India.
8. Muhammed Ali Mazidi and Janice Gillespie Mazidi, 2004, The 8051 Microcontroller and Embedded Systems, Fourth Indian Reprint, Pearson Education.
9. V. Vijayendran, 2002, Fundamentals of Microprocessor –8086- Architecture, Programming (MASM) and interfacing, Viswanathan, Chennai.

Core -6: Microprocessors and Microcontrollers Lab
Course Code: PEPBLT3
Credit: 2 (0+0+2)

Name of the experiments

1. Write an assembly language program to multiply two 16-bit hexadecimal numbers.
2. Write an assembly language program to convert a 16-bit hexadecimal numbers to decimal number
3. To write a language program to generate Fibonacci series.
4. To study working of IC 8086 (interfacing experiment)
5. Write an assembly language program to sort hexadecimal numbers in descending order.
6. Generation of Fibonacci series. Micro controller 8051
7. Addition, subtraction, multiplication and division of two 8-bit numbers.
8. Sum of a series of 8-bit numbers, average of N numbers.
9. Factorial of number, Fibonacci series of N terms.
10. Sorting in ascending and descending order – Picking up smallest and largest number

DSE 1: Advanced Communication System-1
Course Code: PLPBTD1
Credit: 3 (3+0+0)

Course Objectives:

The course aims:

- To understands the basics of Information theory, Source coding techniques and calculate Entropy.
- To study Data communication basics such as TCP/IP and the network management concepts.
- To understand various modulation and multiplexing mechanisms.
- To understand the basics of satellite communications and satellite systems.
- To understand the designing of satellite links and the earth station details and their designing.

Learning Outcomes:

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

- How information is measured in terms of probability and entropy.
- An overview of the concepts and fundamentals of data communication and computer networks.
- Introduction to fundamental technologies of the mobile telecommunications.
- Satellite orbits, link analysis, antenna, interference and propagation effects, modulation techniques, coding, multiple access, and Earth station design.

Unit – I: Introduction to Information and Coding Theories-Information Theory: information measures, Shannon entropy, differential entropy, mutual information, capacity theorem for point-to-point channels with discrete and continuous alphabets.

Unit – II: Introduction to data communication - Introduction to data communication, layered network architecture (OSI and TCP/IP), Public Telephone Network, Cellular Telephone system, data communication codes, error detection and error control, Modems, LAN topologies, Division Multiplexing (WDM) and its network implementation

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Unit – III: Mobile Communication elements and system design - Introduction to Cellular Mobile System - Performance criteria - uniqueness of mobile radio environment - operation of cellular systems- Hexagonal shaped cells - Analog and Digital Cellular systems- General description of the problem - concept of frequency channels -Co-channel Interference Reduction Factor -desired C/I from a normal case in a omnidirectional Antenna system - Cell splitting, consideration of the components of Cellular system

Unit – IV: Satellite communication-Introduction: Orbital mechanics and launching, earth station and satellite sub systems, satellite link: design and analysis, multiplexing techniques, multiple accesses for satellite links: FDMA, TDMA CDMA and DAMA, propagation effects, DBS-TV, GPS. VSAT: Network architecture, access control protocol and link analysis.

Reference Books:

1. Communication Systems" by B P Lathi.
2. Communication Systems" by A B Carlson.
3. Communication Systems: Analog and Digital" by R P Singh and S Sapre
4. Introduction to Communication Systems" by Madhow Upamanyu.
5. Communication Systems" by Michael Moher Simon Haykin.
6. Communication Systems: Analog and Digital" by Sanjay Sharma.
7. Modern Digital and Analog Communication Systems" by B P Lathi and Zhi Ding.
8. Digital Communication: Theory, Techniques and Applications" by R N Mutagi.

DSE 1: Advanced Communication System I Lab
Course Code: PEPBLD1
Credit: 2 (0+0+2)

Name of the experiments

1. Study the sample signal and sample hold signal and its reconstructions.
2. ASK /FSK/ PSK generation and detection
3. Study of Frequency Modulation using Reactance Modulator.
4. Study of Frequency Modulation using Varactor modulator.
5. Study the operation of Quadrature Detector.
6. Study the operation of Detuned Resonance Detector.
7. Study the operation of Foster - Seeley Detector
8. Study the operation of Ratio Detector
9. Study the FM transmitter and receiver.
10. Study the AM transmitter and receiver.

Semester – III

Core-7: Power Semiconductor Devices and Control System
Course Code: PLPCTT1
Credit: 5 (4+1+0)

Course Objectives:

- To introduce students to the basic theory of power semiconductor devices and passive components, their practical applications in power electronics.
- To familiarize students to the principle of operation, design and synthesis of different power conversion circuits and their applications.
- To provide strong foundation for further study of power electronic circuits and systems.

Learning Outcomes: Upon completion of the course, the student should be able to:

- Relate basic semiconductor physics to properties of power devices, and combine circuit mathematics and characteristics of linear and non-linear devices
- Describe basic operation and compare performance of various power semiconductor devices
- Identify the various control system components and their representations.

Unit – I: Fundamentals of Semiconductors: Carrier concentration of semiconductor, Transport Equations, P-N Junction Diode, Schottky Junction Diode and MOSFET. Fundamentals of LED, essential band structures of LED. Fundamentals of semiconductor LASER with detail theory

Unit – II: Introduction to Power Semiconductor devices, Device Basic Structure and Characteristics , High current effects in diodes, Breakdown considerations for various devices, Junction Termination techniques for increasing breakdown voltage, edge termination in devices, beveling, open base transistor breakdown Structure & Performance of Schottky and PIN Power Diodes SCR, DIAC, TRIAC, power transistors, Protection of thyristors against over voltage and over current. SCR triggering - dv/dt and di/dt, triggering with single pulse and train of pulses, A.C. and D.C. motors - construction and speed control. Switched Mode Power Supply (SMPS). Uninterrupted Power Supply (UPS).

Unit – III :Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system.

Unit – IV: Open loop and closed loop control system, Block Diagram reduction techniques, transfer function and signal flow diagram, Stability criterion: Routh-Hurwitz and Nyquist plot, On-off controller, Proportional (P), Proportional-Integral (PI), Proportional-Derivative (PD), PID controllers.

References Books:

1. Baliga,G.J., Fundamentals of Power Semiconductor Devices, Springer.
2. S.M. Sze, Physics of Semiconductor Devices, 2nd ed., Wiley..
3. M.Gopal, ―Control System – Principles and Design‖, Tata McGraw Hill
4. J.Nagrath and M.Gopal, ―Control System Engineering‖, New Age International Publishers.
5. K. Ogata, ‗Modern Control Engineering‘, PHI,
6. S.K.Bhattacharya, Control System Engineering, Pearson,
7. Benjamin.C.Kuo, ―Automatic control systems‖, Prentice Hall of India.

Core-8: Sensors and Transducers
Course Code: PLPCTT2
Credit: 5 (4+1+0)
Course Objectives:

The course aims to develop an understanding of:

- To make students familiar with the constructions and working principle of different types of sensors and transducers.
- To make students aware about the measuring instruments and the methods of measurement and the use of different transducers.
- To know the construction and working of frequently used equipment's like CRO, Signal generator, spectrum analyzer etc.

Learning Outcomes:

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

- Use concepts in common methods for converting a physical parameter into an electrical quantity.
- Classify and explain with examples of Sensors.
- Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light.
- Locate different type of sensors used in real life applications and their importance
- To be familiar with various computers controlled test systems.

Unit – I: Optical sensors: Spectral response, Photoconductive sensors, Junction type photoconductors (PIN and PIN diode, NPN), Photo diode, photo resister, Application of photodiodes and photo resister in light operated relays, Electro-optics, shaft encoder, Photo-voltaic sensors, Photo emissive-sensors.

Unit – II: Transducers-I. Classification of transducers, Selecting a transducers, strain gauge, Gauge factor, Metallic sensing element, Gauge configuration, Idea of displacement transducers, capacitive and inductive transducers, Variable differential transformer, Oscillat ion, transducer.

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Unit – III: Ttansducers-II: Photoelectric transducers, Piezoelectric transducers, potentiometric transducers, velocity transducers, resistive thermometer, thermocouples, thermister characteristic, Thermister application, photosensitive devices, filled phototube, multiplier phototube.

Unit – IV: Oscilloscopes: Cathode ray tube, Electrostatic. Screen of CRT, Idea of CRT circuits, Vertical deflection system, Horizontal deflection system, Delay line, Oscilloscope probes and transducers, Determination of frequency phase angle: and time delay measurements, Idea of storage oscilloscope, sampling Oscilloscope.

References Books:

1. Electric Instrumentation a nd M easurmentTechniques : W.D. C ooper& A. D Helfric.
2. Understanding Oscilloscopes :Sahny, Kulshrest ha, Gupta.

Core-9: Optoelectronics Devices
Course Code: PLPCTT3
Credit: 3 (3+0+0)

Course Objectives:

The course aims to develop an understanding as follows:

- To provide students with an understanding of optoelectronic process, materials and basic structure and working principles of devices such as light emitters, detectors, modulators, energy harvesting devices etc.
- To understand the governing equations to be able to perform calculations to characterize the performance of the devices and,
- To have the practical knowledge and an understanding of the trade-offs when using these devices in their respective applications.

Learning Outcomes:

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

- The students will understand the basic design, optimization, structure, operating principles, required modifications in structures of optoelectronic devices.
- The students will be able to find out newer applications of optoelectronic devices in many areas along with optoelectronic integrated circuits.

Unit – I: Review of Semiconductor Materials: Review of semiconductor materials of interest, Crystal Lattice, Bonding Forces and Energy bands in solids, Metal , Semiconductor and Insulators, Direct and Indirect Semiconductors, E-k diagrams, Electron and Hole concentration at Equilibrium, Density of states, Occupation probability, Fermi level, p-n junction, Schottky junction, Ohmic contacts.

Unit – II: Optical Process in Semiconductors: Electron–Hole pair formation, Radiative and Non-Radiative Recombination, Band-to-Band Recombination, Absorption in Semiconductors, Effect of Electric Field on Absorption: Franz-Keldysh and Stark Effects, Absorption in Quantum Well and Quantum - Confined Stark Effect

Unit – III: Emitters: Light Emitting Diode (LED): Introduction, The electroluminescent process, LED materials, Device configuration and Efficiency, LED Structures: Hetero junction LED, Burrus Surface Emitting LED, Edige Emitting LED, LED drive Circuit, LED characteristics,
Lasers: Absorption, Excitation, Spontaneous emission, population inversion, optical pumping, Stimulated Emission, Laser diode structure, Laser Cavity, Thresh hold conditions, Effect of temperature on Thresh hold current $I_{th}(T)$, Einstein coefficients, Heterojunctions Laser and Quantum well laser

Unit – IV: Photodetectors and Solar Cells: Semiconductor photodetectors, the pin photodetectors (PiN), Avalanche photo detectors (APD): Basic structure, theory and characteristics, Efficiency and responsvity of photodetectors
Introduction of Solar Cells, basic principles: Current–Voltage Characteristics, Parameters of Solar Cells (Voc, Isc, FF, and Efficiency), Heterojunction Solar cells

References Books:

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1. Ajoy Ghatak, Optics, Tata McGraw Hill, New Delhi (2005)
2. J. Wilson and J. F. B. Hawkes, Optoelectronic:sAn Introduction, Prentice Hall India (1996)4.
3. S. 0. Kasap, Optoelectroincs and Photonics: Principles and Practices Pearson Education(2009)
4. Ghatak A.K. and Thyagarajan K., "Introduction to fiber optics," Cambridge Univ. Press. (1998)
5. Ben G. Streetman and Sanjay Kumar Banerjee, “Solid State Electronic Devices” Vith edition, PHI Learning 2013

Core-9: Optoelectronics Devices Lab
Course Code: PLPCLT3
Credit: 2 (0+0+2)

Name of the experiments

1. To study the I-V Characteristics of LED
2. To study the Voltage Vs. Intensity of a semiconductor laser Diode
3. To characterize the laser grating using semiconductor laser diode
4. To verify the law of Malus for plane polarzied light.
5. To find out the characteristics of a photodetector.
6. To characterize the solar cell and find out the FF and Efficiency of a solar Cell.
7. To Study of the Electro-optic Effect using Semiconductor laser diode.
8. To measure the numerci al aperture of an optical fiber. Using Semiconductor laser diode.

Research Methodology: Research Methodology in Electronics
Course Code: PLPCTR1
Credit: 2 (2+0+0)

Objective:

- To introspect the fundamentals of research methodology and its association in diverse areas of science**.**

Course Outcomes:

After completion of this course, post graduate will be able to

- Identify the research gap and various methodologies to solve the problems
- Analyze the data by using different methods and develop presentation skills
- Engage in research in the field of pure and applied physics and involve in lifelong learning

Unit – I: Research and Research Design: Introduction to Research, Types of research: exploratory, conclusive, modeling and algorithmic, , Tools used for review, journals, conferences, books, magazines and their quality and authenticity, effective searches, find relevant papers related to your area of research, capture critical information, understand and identify the bias, theoretical position and evidence produced, compare ideas and concepts from different papers, distinguishing own work from others work and acknowledging such references.

Unit – II: Problem identification and its solution: Identification of research problems, Identify key areas in research field, Identification of a problem and literature survey. Collection of data and analysis, Determine the nature and extension of papers that should be read, Identify the research gaps, Formulate the Problem Statement, Examples of effective and ineffective titles.

Unit – III: Data Analysis: Identify problem and experimental/theoretical data for comparison with proposed model, extrapolate/scale data for validation, Error Analysis and Numerical Methods, editing and coding of data, tabulation, graphic presentation of data, cross tabulation, testing of hypotheses.

Unit – IV: Presentation: Scientific Writing: Goals and Objectives, Structure of documents, importance of clear title, abstract or summary, Main message of presentation, highlight review points, structure of presentation key components of an oral presentation, show support material, feedback on oral presentation, prepare a set of questions.

Reference Books:

1. R L Dominowski: Research Methods (Prentice Hall of India, N J 1980)

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2. John R Rice: Numerical Methods, Software and Analysis (Mc Graw Hill
3. ISE, 1985)
4. Gaur, R. R., Sangal, R., &Bagaria, G. P. (2010). A foundation course in human values and professional ethics. New Delhi: Excel Publishers.
5. Naagarazan, R. S. (2006). A textbook on professional ethics and human values. New Delhi: New Age International Pvt Ltd.
6. Verma, R. (2003). Modern trends in teaching technology. New Delhi: Anmol publishers Pvt. Ltd.
7. Rao, U. (2001). Educational teaching. New Delhi: Himalaya publishing house.

DSE 2: Advanced Communication System-2 **Credit: 3 (3+0+0)**

Course Code: PLPCTD1

Course Objectives:

The course aims to develop an understanding of:

- To understand the details of the various generations and their abilities and limitations.
- To understand the basic concepts of data communication, layered model, protocols and interworking between computer networks and switching components in telecommunication systems.
- To study various concepts related to optical communication.
- To study the functions of various blocks of Radar receivers and detection of Radar Range equation in detail.

Learning Outcomes:

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

- At the end students should have knowledge about Cellular standards including 2G code-division multiple access (CDMA), Time-division multiple access (TDMA), Global System for Mobile (GSM), and Evolution of GSM technologies towards 4G.
- Recognize the different internet devices and their functions.
- This course designed to enable students to develop a full understanding of the components and the design and operation of optical communication systems.
- Analyze the statistical parameters of Noise and Radar cross section of targets

Unit – I: Mobile Communication: Mobile radio propagation.. Diversity. Multiple access. Cellular coverage planning. Wireless networking. Wireless systems and standards. WAP and other protocols for internet access. Data transmission in GSM and UMTS, TCP in wireless environment, multi-user detection and its performance analysis. Blue-tooth and other wireless networks, system comparison. Spread spectrum concept. Basics of CDMA. Applications of CDMA to cellular communication systems. Second and third generation CDMA systems/ standards. Multicarrier CDMA. Synchronization and demodulation. Diversity techniques and rake receiver.

Unit –II: Internet Communication: Modem, Modem-computer interfacing, modulation schemes, computer networks and different topologies, application layer protocols, transport layer protocols, network layer and routing, link layer and local area networks, security in computer networks.

Unit – III: Optical communication: Analog and Digital communication link design. WDM, DWDM, optical add/drop multiplexers, isolators, circulators, optical filters, tunable sources, and tunable filters, arrayed waveguide grating, diffraction grating, optical amplifiers, optical integrated circuits, OTDR, SONET: frame format, overhead channels, payload pointer, multiplexing hierarchy. SDH: Standards, frame structure, and features. Optical switching, WDM networks, and Classification of optical sensors. Intensity-modulated, phase-modulated and spectrally modulated sensors.

Unit – IV: RADAR communication: An introduction to radar, The radar equation, CW, Pulsed Doppler Radar, and MTI, Tracking radar, Receiver noise and losses, Radar clutter., Matched filters, Radar detection and parameter estimation in clutter and noise background, pulse compression and coding techniques, Radar signal choice and ambiguity function, Radar applications.

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Reference Books:

1. Advances in Analog and RF IC Design for Wireless Communication Systems" by imusti.
2. Optical Fibre Communication" by Kaiser
3. Digital Communications Systems : With Satellite And Fiber Optics Applications" by Kolimbiris.
4. Principles of Digital Communication Systems and Computer Networks" by Dr K V K Prasad.
5. Digital and Analog Communication Systems" by K Sam Shanmugam.
6. Digital Communications: Fundamentals and Applications" by Sklar & Ray.
7. Analog and Digital Communication (Special Indian Edition) (Schaum S Outline Series)" by Hsu Hp.

DSE 2: Advanced Communication System-2 Lab
Course Code: PL PCLD1
Credit: 2 (0+0+2)

Name of the experiments

1. Frequency Division Multiplexing and Demultiplexing of two signals
2. Time Division Multiplexing and Demultiplexing of two signals.
3. Wavelength Division Multiplexing and Demultiplexing of two signals.
4. Study of the IR Transmitter & Receiver.
5. Study the optical transmitter and Receiver.
6. Study and design of different types of Antenna.
7. Study the operation of Phase-Locked Loop Detector (IC4046 based)
8. Study of Frequency Modulation using VCO based Frequency modulator (IC XR2206 based).
9. Study of Phase locked loop detector (IC LM565 based) frequency Demodulator.
10. Study of Frequency deviation and modulation index using VCO based Frequency Modulator (IC XR2206 based)

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