List of Revised Courses

Department : *Pure and Applied Physics*

Program Name : *M.Sc. (Electronics)*

Academic Year : 2021-22

List of Revised Courses

Sr. No.	Course Code	Name of the Course
01.	PEPATT2	Semiconductors Materials & Devices
02.	PEPATT3	Analog and Digital Electronics
03.	PEPBTT1	Electromagnetic theory and Wave Propagation
04.	PEPBTD1	Advanced Communication System-1

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

विभागाध्यक्ष/H.O.D.
शुद्ध एवं अनुप्रयुक्त भौतिकी विभाग
Dept. of Pure & Applied Physics
गुरु घासीदास विश्वविद्यालय
Guru Ghasidas Vishwavidyalaya
बिलासपुर (छ.ग.)/Bilaspur (C.G.)

Signature & Seal of HoD

Scheme and Syllabus

Course Structure
M.Sc. Electronics Syllabus 2021-22

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**

Core -2: Semiconductor Materials and Devices

Course Code: PEPATT2

Credits = 3 (3+0+0)

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 - 3: Analog and Digital Electronics

Course Code: PEPATT3

Credits = 3 (3+0+0)

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.

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.

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

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

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.