PHYS1023	Physics for Computer Engineers	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	12th Level Physics				
Co-requisites	12th Level Mathematics				

Course Objectives

1. To demonstrate the principles of LASER and its applications in holography as well as in fiber-optic communications.
2. To determine gradient of scalar fields and divergence & curl vector fields.
3. To develop understanding of electromagnetics, which forms the basis of several contemporary communication systems such as fiber optics communication and it, is also a prerequisite for forthcoming semesters.
4. To utilize fundaments of quantum mechanics in various areas of Material Science and engineering.
5. To understand and apply semiconductor materials in various applications.

Course Outcomes

CO1. Understand the significance of lasers and its application in holography and optical fiber communication.

CO2. Illustrate the electric field for different charge geometries.

CO3. Outline the magnetic field due to different current geometries.

CO4. Utilize the fundamentals of Quantum Mechanics and analyze the behavior of particle in a box.

CO5. Apply and analyze the apply various applications of semiconductor materials in different instruments.

Catalog Description

Physics is the backbone of every engineering stream. It inherently investigates the subtle intricacies of nature and effectively explains various physical processes responsible for such intricacies. The Physics curriculum provides direct coherence of concepts and applications which adhere to the need of understanding engineering in a generic and dynamic manner. An introduction to optics subsequently leads to the understanding of various aspects of LASERs, Holography, Fiber Optics communication system and Optical instrumentation. These topics have revolutionized various technologies in a tremendous fashion. An understanding of electromagnetic theory leads to the conceptualization of signal communication techniques and it also forms the basis of electric signal theory. In Faraday's law, magnetic fields are associated with electromagnetic induction and magnetism. Maxwell's equations describe how electric and magnetic fields are generated and altered by each other and by charges and currents. Quantum Mechanics describes the physical phenomena in which the wave and particle aspects of matter and radiation are reconciled in a unified manner. The knowledge of the Quantum Mechanics

can be applied to the study of optical and electronic sensor as well as to the behavior of the particle at microscopic and nano level. Semiconductor physics is the area of study focused on various semiconducting material, their formation, characteristics, developing various devices and large number of applications in computer and other technologies.

Course Contents

Unit I: Lasers & Fibre Optics **14 lecture hours**

Introduction, Spontaneous and Stimulated emission of radiation, Relation b/w Einstein's A and B coefficients, Population inversion & types of pumping, Main components of a Laser, Construction & working of Ruby Laser and its applications, Construction & working of Helium-Neon laser and its applications. Holography: Elementary idea of holography and constructive and reconstructive of holography.

Fundamental ideas about optical fiber, Types of fibers, Acceptance angle and cone, Numerical aperture, Propagation mechanism and communication in optical fiber, Attenuation and losses.

Unit II: Electro-Magnetics: **16 lecture hours**

Electro-statics: Coordinate systems, Del operator, Gradient, Divergence, Divergence Theorem, Stoke's Theorem, Introduction to electrostatics, calculation of electric field, potential and energy due to charge distribution by vector approach, Gauss law electric flux density. Polarization in Dielectrics, Bound charges, Dielectric Constant and strength, Continuity equation and relaxation time Boundary Conditions.

Magneto-statics: Introduction, Biot-Savart's law, Ampere's Circuit Law; Applications, Magnetic flux density, Faraday's Law, Transformer and motional EMF. Displacement current, Maxwell's Equations in Final form.

Unit III: Quantum Mechanics **15 lecture hours**

Introduction to Quantum Mechanics, photoelectric effect, Compton Effect, Pair production & Annihilation, Wave particle duality, De Broglie waves, Davisson Germer experiment, phase and group velocities and their relations, Thought experiment- Heisenberg's Gamma ray microscope, Uncertainty principle and its applications, Wave function and its interpretation, Normalization, Schrodinger time independent & dependent wave equations, Particle in a 1-D box; generalization to 3-D box.

Unit IV: Semiconductor Physics: **15 lecture hours**

P and N type semiconductors, Energy Level Diagram, Conductivity and Mobility, Concept of Drift velocity, Hall effect, Barrier Formation in PN Junction Diode, Static and Dynamic Resistance, Current Flow Mechanism in Forward and Reverse Biased Diode, Avalanche breakdown, Zener breakdown, Two-terminal Devices and their Applications: Half-wave Rectifiers, Full-wave Rectifiers, Ripple Factor and Rectification Efficiency, Zener Diode and Voltage Regulation, Principle and structure of LED, Photodiode and Solar Cell

Text Books

1. Malik H.K, Singh A.K. (2011) Engineering Physics, TMH, New Delhi. ISBN: 9780070671539

2. Beiser A. (2002) Concepts of Modern Physics, McGraw Hill Education. ISBN: 9780070495531

3. Sadiku M.N.O. (2007) Elements of Electromagnetics, Oxford University Press. ISBN: 0195300483

4. C. T. Bhunia (2010) Introduction to Quantum Computing, New Age International Publishers **ISBN** 978-8122430752

5. Semiconductor Devices: Physics and Technology, S.M. Sze, 2nd Ed., 2002, Wiley India.

6. Electronic Devices & circuits, S.Salivahanan & N.S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill.

Reference Books

1. Griffith D.J. (2012) Introduction to Electromagnetics, PHI Learning, 4th edition, ISBN: 9780138053260.
2. Ghatak A. (2012) Optics, McGraw Hill Education. ISBN: 978-1259004346.
3. Sahni V., Goswami D. (2008) Nano Computing, McGraw Hill Education Asia Ltd., ISBN: 978007024892.

Modes of Evaluation: Class tests/Assignment/Tutorial Assessment/Written Examination

Examination Scheme:

Components	**IA**	**MSE**	**ESE**
Weightage (%)	**30**	**20**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PS O1	PSO 2	PSO3
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	2	3										1			
CO4	3	2										1			
CO5	3	2										1			

1 = weakly mapped, 2 = moderately mapped, 3 = strongly mapped