Physics
(Common to all branches)

Course Type: *General Institute Requirement (GIR)* ***Pre-requisites:*** *Nil*

Course Code: *PHIR11* ***No. of Credits:*** *03*

Course Objectives

1. *To introduce the notions of light matter interaction, fabrication of lasers, light propagation in waveguides, applications of lasers and optical fibers to engineering students.*

2. *To comprehend and explain the concepts of matter waves, wave functions and its interpretation to understand the matter at atomic scale.*

3. *To teach the fundamentals of nuclear forces, models and classification of matter.*

4. *To impart knowledge about the basics of dielectrics, conductors, superconductors, and their applications in science, engineering and technology.*

5. *To understand the behavior of matter at the atomic scale and the macroscopic behavior of materials.*

Lasers

Introduction to Laser-characteristics of Lasers-spontaneous and stimulated emissions – Einstein's coefficients – population inversion and lasing action – laser systems: He-Ne Laser, semiconductor laser-applications.

Fiber Optics

Fermat's principle-optical fiber – principle and construction – acceptance cone - numerical aperture –types of fibers - fiber optic communication principle – fiber optic sensors.

Quantum Mechanics

Inadequacy of classical mechanics-black body radiation, photoelectric effect-wave and particle duality of radiation – de Broglie concept of matter waves – electron diffraction – Heisenberg's uncertainty principle – Schrodinger's wave equation – eigen values and eigen functions – superposition principle – interpretation of wave function – particle confined in one dimensional infinite square well potential.

Nuclear and Particle Physics

Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity - types and half-life. Fundamental forces - Particle physics - classification of matter - quark model.

Physics of Materials

Dielectric materials - electric polarization - Clausius-Mossotti relation- *Conductors:* classical free electron theory (Lorentz –Drude theory) – electrical conductivity - classification of magnetic materials - *Superconductors:* definition – Meissner effect – type I & II superconductors – BCS theory (qualitative).

References

1. Laser Fundamentals, William T. Silfvast, 2nd edn, Cambridge University press, New York (2004).

2. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York (2001).

3. Concepts of Modern Physics, Arthur Beiser, Tata McGraw-Hill, New Delhi (2010).

4. Fundamentals of Physics II, R. Shankar, Yale University Press, New Haven and London (2016).

5. Introduction to Solid State Physics, 8th Edition, Charles Kittel, John Wiley & Sons, NJ, USA (2005).

Course Outcomes

On completion of this course, the students will be able to,

1. *know principle, construction and working of lasers and their applications in various science and engineering.*
2. *explain light propagation in optical fibers, types and their applications.*
3. *experience and appreciate the behaviour of matter at atomic scale, and to impart knowledge in solving problems in modern science and engineering.*
4. *understand the role of nuclear and particle physics in applications like radioactivity and nuclear reactions.*
5. *recognize, choose and apply knowledge to develop materials for specific applications for common needs.*

Theory *PHIR11*		**Aligned Programme Outcomes (PO) with level of correlation** **Programme Outcomes (COs)**											
Course Outcomes(Cos)		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
	CO1	H	M	H	-	M	L	-	-	-	-	-	M
	CO2	H	M	H	-	M	L	-	-	-	-	-	M
	CO3	L	H	-	-	-	-	-	-	-	-	-	H
	CO4	L	H	M	-	-	H	M	-	-	-	-	H
	CO5	M	M	H	-	H	L	M	-	-	-	-	H

H(High)- 3 (100- 68%) , M (Medium) – 2 (34-67%) , L(Low) – 1 (0-33%)