Physics-I
(Common to all branches, June 2019 onwards)

Course Type : *General Institute Requirement (GIR)* ***Course Code:*** *PHIR11*
No. of Credits: *03* ***Pre-requisites:*** *Nil*

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 conductors, superconductors, nanomaterials and their applications in science, engineering and technology.*

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
Snell's law-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 Advanced Materials

Conductors: classical free electron theory (Lorentz –Drude theory) – electrical conductivity. *Superconductors:* definition – Meissner effect – type I & II superconductors – BCS theory (qualitative). *Nanomaterials:* introduction and properties – synthesis – top-down and bottom-up approach – applications.

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, R. Shankar, Yale University Press, New Haven and London (2014).

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

6.Introduction to Nanotechnology, C.P. Poole and F.J. Owens, Wiley, New Delhi (2007).

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

Course Outcome

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.*

Physics-II
(Common to all branches, June 2019 onwards)

Course Type: *General Institute Requirement (GIR)* ***Course Code:*** *PHIR12*
No. of Credits: *02* ***Pre-requisites:*** *Nil*

Course Objectives

1. *To introduce the spirit of experiments to verify physics concepts such as reflection, refraction, diffraction and interference on light matter interaction.*

2. *To perform experiments to estimate the materials properties and to check their suitability in science and engineering.*

3. *To familiarize physics concepts and to design instruments and experimental set up for better and accurate measurements.*

4. *To teach and apply knowledge to measure and verify the values of certain constants in physics.*

LABORATORY

1. Determination of rigidity modulus of a metallic wire
2. Conversion of galvanometer into ammeter and voltmeter
3. Wavelength of laser using diffraction grating
4. Dispersive power of a prism – Spectrometer
5. Radius of curvature of lens-Newton's Rings
6. Numerical aperture of an optical fiber
7. Field along the axis of a Circular coil
8. Wavelengths of white light – Spectrometer
9. Calibration of Voltmeter – Potentiometer
10. Thickness of a thin wire – Air Wedge
11. Specific rotation of a liquid – Half Shade Polarimeter
12. Photoelectric effect – Planck's constant

References

1. Physics Laboratory Manual, Department of Physics, National Institute of Technology Tiruchirappalli (2018).
2. Practical Physics, R.K. Shukla, Anchal Srivastava, New age international (2011).
3. *B.Sc. Practical Physics, C.L Arora, S. Chand & Co. (2012).*

Course Outcome

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

1. *know how to calibrate a galvanometer and convert it into a current and voltmeters.*

2. *to make experimental setup to verify certain physics concepts of wave and particle nature of light.*

3. *understand the light propagation in fibers, light matter interaction and use of lasers in science and engineering.*

4. *acquire knowledge, estimate and suggest materials for engineering applications.*