DEPARTMENT OF PHYSICS
Faculty of Mathematics & Computer Science
South Asian University, New Delhi, India

Course Title: Engineering Physics **Course Code: PHY 101**
Credits: 05 **Pre-requisite: None**

COURSE OBJECTIVES:

Engineering Physics (EP) imparts knowledge to understand the basic concepts of nature around us and to implement this knowledge for analysing and solving various critical problems in engineering. The course is designed for students with no experience in Physics, make them understandable to the point where they can gain knowledge from the natural phenomenon occurring and apply this basic knowledge to solve the practical problems. The course introduces the fundamental concepts in order to understand the advances in technology for practical applications. At the end of the course, the students will be able to (i) discuss the basic characteristics of wave motion, compute the wave equation of wave motion, and differentiate between diffraction, interference & polarization. (ii) explain the fundamentals of quantum mechanics and apply it to one dimensional motion of particles (iii) describe the principle and working of various lasers and to recognize the important industrial applications of lasers (iv) understand the structural and performance difference of different types of optical fibres and the light propagation through optical fibres.

COURSE STRUCTURE:

Oscillations and waves

Waves: types of waves, free, damped and forced oscillations, Simple pendulum, wave properties, Simple harmonic motion, wave motion and energy of harmonic oscillators.

Wave optics

Interference of waves: Interference of light by amplitude division, Phase difference, Path difference, Conditions for interference, Types of interference, Theory of interference fringes, Interference in thin films, Newton's ring experiment, Diffraction: Diffraction due to single slit, diffraction grating, Dispersive power of a grating, Polarized and unpolarized light, Brewster's law, Law of Malus, Nicol prisms as a polarizer and analyser.

Lasers

Absorption and emission of radiation, Main features of a laser, Characteristics of a laser beam, Condition for light amplification, Basic requirement for Laser, Population Inversion – Threshold Condition, Three level and four level systems. Classification of Lasers: Solid State Laser-Ruby laser and Gas Laser- He-Ne laser (Principle, Construction and working), Semiconductor laser (Principle, Construction and working), Applications of lasers in the field of medicine, Industry, Environment and Communication.

Fibre Optics

Optical fibres, Propagation of light in optical fibres, Total internal refection, Acceptance angle and numerical aperture, Types of optical fibres- Single and multi mode, Step index and Graded index optical fibres, V-number or Number of modes in fibre, Fibre optics communication system, Signal losses in Fibres and dispersion, Applications and uses of optical fibres.

Quantum Mechanics

Limitations of Classical mechanics, Introduction to Quantum mechanics, Black body radiations, Photoelectric effect, Compton effect, Dual nature of matter, De-Broglie hypothesis, Properties of matter waves, Wave packet, Heisenberg's Uncertainty Principle – Significance and properties of wave function, Schrodinger's time independent and dependent wave equations, Particle in a one-dimensional infinite potential well.

Semiconductors

Formation of energy bands – classification of crystalline solids - Intrinsic & extrinsic semiconductors, P and N type semiconductors, Fermi level, Dependence of Fermi energy on carrier concentration and temperature, Formation of PN junction diode, Direct and indirect band gap semiconductors, LED: materials and uses, Solar cell: working principle, characteristics and applications.

READING SUGGESTIONS:

1. John W. Jewett & Raymond A. Serway (2017). Physics for Scientists and Engineers. Cengage India Private Limited
2. Jacob Millman & Charistos C. Halkias (2017). Integrated Electronics. Mc-Graw Hill.
3. Carl J. Pratt (2021). Quantum Mechanics. Stefano Solimito
4. Eugene Hecht (2019). Optics. Pearson.
5. Halliday D., Resnick R. & Walker J. (2020). Fundamentals of Physics. Wiley Publications.

ASSESSMENT CRITERIA:

1. Quiz-1: 10%
2. Quiz-2: 10%
3. Lab assignments: 20%
4. Mid-Semester Examination: 20%
5. End-Semester Examination: 40%