

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY, Guwahati

Course Structure and Syllabus - Physics (Odd semester)

MODULE 1: Introduction to Electromagnetism (8 Lectures)

Introduction to Gradient, Divergence and Curl, Laplace's and Poisson's equation for electrostatic potential. (2 lectures)

Biot-Savart law, Ampere's law, Inconsistency in Ampere's law, Continuity equation, Displacement current, Maxwell's equations with significance. (3 lectures)

Classification of magnetic materials – Diamagnetism, Paramagnetism, Ferromagnetism, Domain theory, Hysteresis loop, Hysteresis loss, Soft and Hard magnetic materials. (3 lectures)

MODULE 2: Optics (7 Lectures)

Aberration in lenses, Spherical and Chromatic Aberration, Method of minimization of Spherical and Chromatic Aberration. (3 Lectures)

Interference of light by division of wave front (brief discussion) & division of amplitude, Interference due to reflected light in plane parallel film, Interference in variable thickness (wedge shaped) film, Newton's rings. (4 Lectures)

MODULE 3: Lasers, Fibre Optics and Holography (9 Lectures)

Induced absorption, spontaneous and stimulated emission, Einstein's coefficients, population inversion, pumping, meta-stable state, principle of LASER, characteristics of a laser beam, Gas (He-Ne) laser, Solid state (Nd:YAG) laser and semiconductor laser, Applications of lasers. (4 Lectures)

Optical fibre - Principle and Structure, Propagation of light in optical fibres, Numerical aperture and angle of acceptance, Classification of optical fibres – Fiber optics materials, Single mode and Multimode optical fibres, Step Index and Graded Index optical fibres, Losses in fibres, Optical fibre communication system (Block diagram only), Introduction to Holography. (5 Lectures)

MODULE 4: Quantum Mechanics (5 Lectures)

Wave nature of particles, Uncertainty principle, Wave function and wave packets, Time dependent & time independent Schrodinger equation, Solution of Schrödinger's equation for one dimensional problem: Particle in a box.

MODULE 5: Solid, Semiconductors and Superconductivity (9 Lectures)

Free electron theory of metals, Density of States, Fermi level, Kronig Penny Model (Qualitative) and origin of energy bands: Metals, Semiconductors and Insulators, Solar Cell, LED, Hall effect. (5 Lectures)

Properties of Superconductors; Meissner effect, Critical Magnetic Field, Isotope effect, Persistent current, Magnetic levitation, Type-1 & Type-2 superconductors and their comparison, BCS theory of superconductivity (qualitative only). (4 Lectures)

Text Books:

1. Applied Physics for Engineers – Neeraj Mehta (PHI Learning Pvt. Limited)
2. A text Book of Engineering Physics – Dr. M.N. Avadhanulu and Dr. P.G. Kshirsagar (S. Chand and Company Pvt. Limited)

Reference Books:

1. Introduction to Electrodynamics – D. J. Griffiths (Prentice Hall)
2. A Detailed text book of Engineering – Dr. S.P. Basavaraju (Subhas Stores, Bangalore)

List of Experiments:

1. To find the Young's Modulus of Elasticity of the material of a wire by Searle's apparatus.
2. To find the value of the acceleration due to gravity by using: Bar Pendulum /Kater's Pendulum.
3. To determine the radius of curvature of the curved surface of the Plano convex lens or the wavelength of the source of light by Newton's Ring Method.
4. To determine the value of Mechanical Equivalent of heat, J by electrical method (using Joule's Calorimeter).

5. To find the Horizontal component of the Earth's magnetic field by using magnetometers.
6. To find the current flowing in an external circuit by using a potentiometer.
7. To find the powers of two given lenses (concave and convex), by using an optical bench.
8. To draw the characteristics curves of a Semiconductor Diode (p-n junction diode).
9. To find the value of a low resistance by the drop of potential method using a Meter Bridge.
10. To find the angle of acceptance and hence calculate the numerical aperture of an optical fibre.

Text Books:

1. A Text Book on Practical Physics – K.G. Mazumdar and B. Ghosh (Sreedhar Publishers).
2. A Text book of Practical Physics - Samir Kumar Ghosh (New Central Book Agency).