Engineering Physics

EG.....SH

Theory : 4
Tutorial : 1
Practical : 2

Year : I
Part : I/II

Course objectives : To provide the concept and knowledge of Physics with the emphasis of present day application. The background of Physics corresponding to Proficiency Certificate Level is assumed.

1 Oscillation (7 hours)

1.1 Mechanical Oscillation: Introduction of SHM-Review only
1.2 Free Oscillation: Equation, Energy, spring mass system, Physical Pendulum-Bar Pendulum and Torsional pendulum
1.3 Damped and Forced oscillation: Equation, Resonance, Quality Factor
1.4 EM Oscillation: LC oscillation; analogy to SHM; Damped Oscillation; Electromagnetic oscillations in LCR circuit; Forced oscillation: LCR circuit, resonance, Quality Factor

2 Wave motion (2 hours)

2.1 Waves and particles; wave velocity and particle velocity; particle acceleration; Types of waves;
2.2 Progressive wave: equation; differential equation
2.3 Energy, power and intensity of plane progressive wave

3 Acoustics (3 hours)

3.1 Reverberation; absorption coefficient;
3.2 Sabine's Law; conditions for good acoustics $\left(T = \frac{0.165V}{A\bar{\alpha}}\right)$
3.3 Ultrasonics: Introduction; production; applications: test of structure and materials; medical uses

4 Physical Optics (12 hours)

4.1 **Interference**: Introduction; coherence; mathematical analysis; Young's double slit experiment; Intensity in double slit interference; Interference in thin films and wedges; Newton's rings; Haidinger fringes
4.2 **Diffraction**: Introduction; Fresnel and Fraunhoffer's diffraction; diffraction and intensity due to a single slit; diffraction grating: introduction, dispersive and resolving; X-ray diffraction: uses of X-ray in material testing
4.3 **Polarization**: Introduction; double refraction; ordinary and extraordinary rays; Nichol prism; quarter and half wave plates; plane, elliptical and circular polarized light; optical activity: specific rotation –measurement and uses

5 **Geometrical Optics** **(3 hours)**

5.1 Lenses: Review of refraction through lenses; combination of two lenses separated by a finite distance

5.2 cardinal points: definitions with suitable diagrams

5.3 chromatic aberration: definition, longitudinal chromatic aberration, circle of least confusion, achromatism

6 **Laser and Fiber Optics** **(4 hours)**

6.1 **Laser**: Laser and ordinary light; Spontaneous and Stimulated emission; Optical Pumping; He-Ne laser; Semiconductor Laser; Uses of laser; Holography

6.2 **Fiber Optics**: Introduction; Propagation of light wave; types of optical fiber-step and graded index; fiber transmission – single and multimode; self focusing; acceptance angle; Numerical Aperture; fiber loss; dispersion; applications

7 **Electrostatics** **(8 hours)**

7.1 Electric charge; Electric force

7.2 Electric field and potential: dipole, quadrupole, line, ring, and disc; Electrostatic potential energy

7.3 Gauss law and its uses in dielectric sphere

7.4 Capacitors: parallel plate, cylindrical, and spherical; energy density; capacitor with dielectric: dielectrics and Gauss law

7.5 Charging and discharging of a capacitor; high intensity electrostatic fields: uses and hazards

8 **Electromagnetism** **(11 hours)**

8.1 **Direct current:**

8.1.1 Electric current and current density, microscopic view of Ohm's law, resistance and resistivity

8.1.2 semiconductor and superconductor

8.2 **Magnetic fields**:

Magnetic flux, magnetic force and torque; Hall effect, cyclotron, synchrotron, Magnetic field; Biot Savart law: magnetic field due to a current in a circular loop; Ampere's circuit law: magnetic fields outside and inside a long straight wire carrying current; electromagnetic induction: Faraday's laws; induction and energy transformation; induced electric field; self and mutual induction; LR circuit; energy stored in a magnetic field; energy density of magnetic field; induced magnetic field; displacement current

9 **Electromagnetic waves** **(5 hours)**

9.1 Maxwell's equations (differential and integral forms); wave equations in free space; non conducting and conducting medium; speed and amplitude of electromagnetic waves; E and B fields; continuity equation; Energy transfer and pointing vector; radiation pressure