ENGINEERING PHYSICS

Course code: SH 106

Lecturer: 4 **Year: I**
Tutorial: **Part: II**
Practical: **Course Credit: 4**

Course objectives: To provide the concept and knowledge of physics with the emphasis of present day application. The background of physics corresponding to +2 or Proficiency Certificate Level is assumed.

Teaching schedule Hours/week				Examination scheme				
				Internal assessment		Final		Total marks
Cr	Theory	Tutorial	Practical	Theory	Practical	Theory	Practical	125
	4	2	2	40	10	60	15	

1. **Mechanical Oscillation(6 hours)**

Physical pendulum
- 1.1.1 Introduction
- 1.1.2 Bar pendulum
- 1.1.3 Interchageability of point of suspension and point of oscillation
- 1.1.4 Minimum time period in case of physical pendulum
- 1.1.5 Torsional pendulum

1.2 Oscillation
- 1.2.1 Free oscillation
- 1.2.2 Damped oscillation
- 1.2.3 Difference between free and damped oscillation
- 1.2.4 Energy in damped oscillation
- 1.2.5 Forced oscillation and resonance
- 1.2.6 Sharpness of resonance
- 1.2.7 Quality factor

1. **Acoustics(3 hours)**

2.1 Introduction
- 2.1.1 Threshold of hearing and loudness
- 2.1.2 Reverberation and reverberation time
- 2.1.3 Absorption coefficient
- 2.1.4 Sabine's Law
- 2.1.5 Conditions for good acoustics

2.2 Ultrasonic
- 2.2.1 Introduction
- 2.2.2 Production of ultrasonics(piezoelectric)
- 2.2.3 Test of structure and materials
- 2.2.4 Medical uses
- 2.2.5 Applications of ultrasonics

2. Relativity [6 hours]

3.1 Frame of reference;
3.2 Inertial and non – inertial frame of references
3.3 Postulates of special theory of relativity
3.4 Lorentz transformation equations; Length contraction; Time dilation. Twin paradox

3.3 Simultaneity; Relativistic mass; Mass and Energy
3.4 Space – time diagram

4. **Optics (18 hours)**

4.1 Geometrical Optics(3 hours)
4.1.1 Lenses, combination of lenses
4.1.2 Cardinal points
4.1.3 Chromatic aberration

4.2 **Laser (2 hours)**
4.2.1 Introduction
4.2.2 Laser and ordinary light, properties of laser production
4.2.3 Induced absorption, spontaneous and stimulated emission active medium, population inversion, metastable state, pumping
4.2.4 He-Ne laser,
4.2.5 Semiconductor laser
4.2.6 Uses of laser

4.3 **Fiber Optics (2 hours)**

4.3.1 Introduction
4.3.2 Acceptance angle and numerical aperture
4.3.3 Types of optical fibre: step index and graded index
4.3.4 Fiber transmission – single and multimode
4.3.5 Self-focusing
4.3.6 Applications of Optical fiber

4.4 **Physical Optics(12 hours)**
4.4.1 Interference
4.4.2 Intensity in double slit interference
4.4.3 Interference in thin films (reflected and transmitted light)
4.4.4 Fringes produced by wedge – shape thin film
4.4.5 Newton's rings (reflected and transmitted light)
4.4.6 Determination of wavelength of monochromatic light and refractive index given liquid by using Newton’s ring

4.5 Diffraction
4.5.1 Introduction: Fresnel and Fraunhoffer’s diffraction
4.5.2 Fraunhoffer’s diffraction at single slit and double slit
4.5.3 Intensity in single slit due diffraction
4.5.4 Intensity due to a single slit
4.5.5 Diffraction grating
4.5.6 X-ray diffraction, X-ray for material test

4.6 Polarization
4.6.1 Introduction Double refraction, Nichol prism
4.6.2 Wave plates (quarter and half wave plate)
4.6.3 Linearly, elliptical and circularly polarized light (qualitatively and quantitavely)
4.6.4 Optical activity, Specific rotation

5 **Electrostatics(8 hours)**

- 5.1 Electric field
  - 5.1.1 Electric field due to an electric dipole (axial line and equatorial line)
  - 5.1.2 Electric dipole in an external field
  - 5.1.3 Electric field due to a linear quadrupole (along axial line)
  - 5.1.4 Electric field due to continuous charge system (line of charge, ring of charge, and disc of charge)
- 5.2 Electric Potential
  - 5.2.1 Potential due to electric dipole
  - 5.2.2 Potential due to linear quadrupole
  - 5.2.3 Potential due to continuous charge system (ring of charge and disk of charge)
  - 5.2.4 Electrostatic potential energy
  - 5.2.5 Capacitors,
  - 5.2.6 Charging and discharging of capacitor
  - 5.2.7 Capacitor with dielectric and Gauss law

6 **Electromagnetism(6 hours)**

- 6.1 **Electromagnetic induction:**
  - 6.1.1 Hall effect
  - 6.1.2 Cyclotron, Synchrotron
  - 6.1.3 Faraday's law of electromagnetic induction and energy transformation
  - 6.1.4 Induced electric field
  - 6.1.5 Self-induction and mutual induction
  - 6.1.6 LR circuit
  - 6.1.7 Energy stored in a magnetic field and energy density
  - 6.1.8 Induced Magnetic field: modified Ampere's law
  - 6.1.9 Displacement current
  - 6.1.10 Eddy current:
  - 6.1.11 Itroduction
  - 6.1.12 Induction stove

7 **Electromagnetic Waves(6 hours)**

- 7.1 Gauss divergence theorem and Stoke's theorem (statement only)
- 7.2 Maxwell's equations
  - 7.2.1 Integral and differential form
  - 7.2.2 Equation of continuity
  - 7.2.3 Conversion of Maxwell's equation from integral to differential form and differential to integral form
  - 7.2.4 Wave equations in free space and in medium
  - 7.2.5 Speed of electromagnetic wave, Ratio of electric field and magnetic field
  - 7.2.6 Poynting vector

8 **Photon and Matter Waves(6 hours)**

- 8.1 Quantum physics
  - 8.1.1 Inadequacy of classical mechanics and need of quantum mechanics
  - 8.1.2 Quantization of energy
- 8.2 Matter wave:
  - 8.2.1 Electron and matter wave
  - 8.2.2 de - Broglie wave equation
  - 8.2.3 Group velocity and phase velocity

8.2.4 Relation between group velocity and phase velocity
8.2.5 Heisenberg uncertainty principle
8.2.6 Wave function and its significance

8.3 Schrodinger wave equation
8.3.1 Schrodinger wave equation (Time dependent and independent)
8.3.2 Probability distribution
8.3.3 One dimensional potential well
8.3.4 Barrier tunnelling (reflection and transmission coefficient)

Laboratory

1. To determine the acceleration due to gravity and the radius of gyration of the bar pendulum
2. To determine the modulus elasticity of the given material and moment of inertia of the circular disc about the wire as in an axis passing through its centre and perpendicular to its plane by using torsional pendulum.
3. To determine wavelength of sodium light using newton's ring
4. To determine the wavelength of LASER light using diffraction grating
5. To determine the capacitance of the given capacitor by the method of charging and discharging through resistor
6. To plot a graph between frequency and current in LCR series circuit and hence determine the quality factor of the circuit.
7. To determine the dielectric constant of the given material.

References:

1. Fundamentals of Physics: Halliday, Resnick, Walker (Latest Edition)
2. A text book of Optics: Brij Lal and Subrahmanyam (Latest edition)
3. Modern Engineering Physics: A. S.Basudeva
4. Engineering Physics: R. K.Gaur and S. L.Gupta
5. Waves and Oscillation: Brij Lal and Subrahmanyam

Evaluation Scheme:
There will be questions covering all the chapters in the syllabus. The evaluation scheme for the question will be as indicated in the table below:

Chapter	Hours	Mark distribution*
1	9	6
2	3	2
3	5	6
4	18	16
5	8	7
6	6	6
7	6	7
8	6	10
Total	60	60

Note: There may be minor deviation in mark distribution.