

# PHYSICS

Teaching Hours: 75  
Full Marks: 50(35+15)  
Pass Marks: 20(14+6)

## I. Introduction

This course in Physics is designed to provide students with sufficient understanding and knowledge of the fundamental Physics contents as per equivalent to Higher Secondary Level. The course demands emphasis on conceptual understanding of the physical phenomena. This will involve the proper utilization of suitable mathematical models and equations. The practical component of this course is designed to supplement learning through the application of learned theory. The nature of the course is both theoretical and practical.

## II. General Objectives

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

- a. acquaint with principles of physics and their applications to become confident citizens in a technological world.
- b. handle simple apparatus to determine physical quantities, verify simple laws and apply their knowledge of physics to real life examples.

## III. Specific Objectives

Upon completion of this course, the students will be able to:

- (a) explain physical phenomena in terms of theories and models,
- (b) apply knowledge of physical laws and principles to familiar and unfamiliar situations,
- (c) present information in the language of physics or their appropriate form, and
- (d) design simple experiments to develop relations among physical quantities and draw conclusions.

## IV. Course Contents

### Unit I: Mechanics

**10 hrs**

1. Simple Harmonic Motion-Equation of S.H.M; Period, Oscillating systems-spring and mass, Simple pendulum, Potential and kinetic energy exchange in oscillating systems, and
2. Rotational Dynamics- Rotational kinetic Energy, Moment of inertia, Torque on rotating body, Work done by a couple, Angular momentum and its conservation, Kinetic energy of rolling object.

**Unit II: Heat and Thermodynamics****10 hrs**

1. Kinetics Theory of Gas-Postulates; pressure evaluation; Root mean square speed; variation of R.M.S. speed; Boltzman constant
2. First law of thermodynamics-Work done by gas, Latent heat and internal energy; First law of thermodynamic; Isothermal and adiabatic changes and work done in reversible Isothermal expansion, Equation of reversible adiabatic; Heat capacities of gases; molar heat capacities, enthalpy, and
3. Second law of thermodynamics-Heat and mechanical work in engines; Carnot cycle and efficiency, Refrigerators and the second law.

**Unit III: Physical Optics****10 hrs**

1. Optics – wave theory of light, Interference, Diffraction, Polarization

**Unit IV: Sound****10 hrs**

1. Wave in pipes and strings-Stationery waves in closed and open pipes; overtones in closed and open organ pipes, End correction in pipes, Resonance Tube experiment, Velocity of transverse waves along a stretched string, vibration of string and overtones; Laws of vibration of fixed string, waves in rods, Dopplers effect.

**Unit V: Electrostatics and Electrical Circuit****15 hrs**

1. Electrostatic field- Electric field, Electric flux, Gauss's theorem; Field due to a charged sphere and plane conductor;
2. Capacitors-Charging and discharging of capacitors, Capacitance; factor determining capacitance, parallels plate capacitor, capacitance of isolated sphere, dielectric constant and Dielectric strength, Action of dielectric, Arrangement of capacitors, Energy of charged capacitor, loss of energy
3. Electrical circuits-Kirchhoffs laws; Wheatstone Bridge circuit; P.O. Box, Meter Bridge; Potentiometer; Comparison of e.m.f., measurement of internal resistances of a cell.

**Unit VI: Electro Magnet and A.C.****10 hrs**

1. Magnetic Effect of Current-Oersted's discovery, Direction of current and field Force on Conductor, Force on moving charge, Torque on rectangular coil, Moving coil galvanometer, forces between current carrying conductors, Biot and Savart law, Ampere's law

2. A.C. Circuits-AC through resistor, capacitor and inductor, phasor diagram, Series circuits containing combination of resistance, capacitance and inductance;

**Unit VII: Modern Physics**

**10 hrs**

1. Quantization of energy-Frank and Hertz experiment, Bohr's theory of hydrogen atom, spectral series, Excitation and ionization potential, Energy level, Emission and absorption spectra, De Broglie Theory, Duality, uncertainty principle, Lasers.
2. Semiconductors- energy band in solids, charge carriers; N-Type and P-type, effect of temperature on P and N type semiconductors, P.N. Junctions, Junction diode, Full wave rectification, Filter circuit, Solar cell, Photo-diode, LED, Zener diode as a voltage regulator, Transistor; common emitter characteristics, Logic gates; NOT, OR, AND, NAND and NOR

## V. EVALUATION SCHEMS (Theory + Practical )

Chapter	Teaching Load in Hrs.	L.Q.	S.Q.	Num. Q.	Marks Distributions			Total
					L.Q.	S.Q.	Num. Q.	
MECH.	06	1*	1	×	4	1	×	5
HEAT & THERM.	10	½	2	1	4/8	2	3	9
PHYSICAL OPTICS	08	1	1	1	3	1	3	7
SOUND	06	*	2	1*	*	2	3	5
EL. STAT & EL. CKT	10	1	2	1	4	2	3	9
EL. MAGT & A.C.	10	½	2	1	4/8	2	3	9
MOD. PHYS	10	½	2	1	4/8	2	3	9
<b>TOTAL</b>	<b>60</b>	<b>6/9</b>	<b>12</b>	<b>5/6</b>	<b>23/25</b>	<b>12</b>	<b>15/18</b>	<b>50</b>

Theory: 35

Practical: 15

- In sound and mechanics; either ask long question of 4 marks from mechanics and numerical problems of 3 marks from sound or vice versa.

## VI. Instructional Materials

LCD Projector and Computer, Demonstration Kit, Chart and Graph Paper

## VII. List of Experiments

1. To determine the acceleration due to gravity of a place using simple pendulum. Hence determine the length of second pendulum.
2. To determine the Young's modulus of elasticity of a given wire using Vernier method.
3. To determine the surface tension of water using Capillary tube method.
4. To determine the coefficient of viscosity of a given liquid using Stoke's method.
5. To determine the melting point of wax using cooling curve method.
6. To determine the specific heat of solid capacity by the method of mixture.
7. To determine the specific heat capacity of liquid using cooling method.
8. To determine the coefficient of linear expansion using Pullinger's method.

9. To determine the magnetic moment and pole strength of a given magnet using deflection magnetometer.
  10. To determine the angle of dip of a place using Dip Circle.
  11. To determine the frequency of a tuning fork using sonometer.
  12. To determine the frequency of AC mains using sonometer.
  13. To determine the velocity of sound at room temperature using resonance air column method. Hence find the end correction.
  14. To determine the resistivity of a given resistor using P.O. Box.
  15. To compare the emf of two cells using Potentiometer.
  16. To determine the high resistance of a given sample using substitution method.
  17. To determine the capacitance of a capacitor using half life method.
  18. To study the characteristics curves of a junction Diode.
- (At least 10 experiments must be performed.)

## **VII. Textbooks**

2. Advance Level Physics, Nelkon, N. and Parker, P.; Arnold-Heinemann Publishers.
3. Physics Practical Guide, Shrestha, U.P., Ratna Pustak Bhandhar publishers.

## **VIII. References**

1. Principle of Physics, Brij Lal and Subramanyam, N; S.Chand and Company
2. University Physics, Sear F.W., M.W. Zeemanskey, H.D. Young and R.A. Freedman, Pearson and education, 2004

**Physics**  
(Model Questions)

Full Marks: 35  
Pass Marks: 14  
Time: 90 Minutes

**Section- A**

1. **Attempt all the questions.** (1 × 10 = 10)

- i. A pendulum clock taken on top of a hill loses time. Why?
- ii. What is wave front?
- iii. What is meant by electric flux?
- iv. Why do capacitor blocks direct current?
- v. What is meant by end correction in pipes?

**Fill in the blanks**

- vi. Boltzman constant is the ratio of two Universal constants ..... and .....
- vii. In isothermal process, internal energy of a system .....
- viii. For a pipe of length  $l$ , the distance between two nodes or antinodes is equal to .....
- ix. When battery is being charged, the terminal potential difference ..... its emf.

OR

- In R-C A.C. circuit, voltage ..... the current by phase angle  $\theta$ .
- x. Semi-conductor is that type of material which behaves like .....at very low temperature and as a ..... at room temperature.

OR

OR gate is a device which produces out put when ..... are present.

**Section-B**

**Attempt any five questions**

(5 × 3 = 15)

2. What is meant by moment of inertia? How it is related to rotational kinetic energy of a body? (3)
3. Show that for an ideal gas  $C_p - C_v = R$ ; where symbols have their usual meaning. (3)

OR

- Explain the working of a petrol engine with the help of P-V diagram.
4. What is polarization of light? Show that light waves are transverse waves? (3)
  5. State Kirchhoff's circuit rules and use these to find the balance condition in Wheatstone bridge circuit. (3)
  6. Obtain expression for impedance and current in a series L-C-R circuit having an A.C. applied. (3)

OR

- Use Biot and Savart law to find magnetic field at the center of a circular coil carrying Current.
7. Describe a semi-conductor diode as a full wave rectifier. (3)

OR

- What is meant by stimulated emission? Explain the working of He. Ne lasers.
8. The fundamental frequency of a guitar string is 220 Hz. The vibrating portion of the string is 60 cm long and having a mass 1.29g. Find the tension applied. (3)

### Section-C

**Attempt any Four questions**

(2 × 5 = 10)

9. A Carnot engine is operated between two heat reservoirs at temperatures of 400K and 300K. If the engine receives 1200J of heat from the high temperature reservoir in one cycle, calculate the work done by the engine and the heat it rejects to the sink.
10. Two slits are spaced 0.3 mm apart and are placed 50 cm from a screen. What is the distance between the second and third dark line of the interference pattern when the slits are illuminated with light of 600 nm wavelength.
11. Calculate the area of paper necessary to make a capacitor of capacitance of 0.4 nF, if the paper has dielectric constant 2.5 and thickness 0.025 mm.
12. A particle having three electric charges is pass through a magnetic fields of  $8 \times 10^{-3} \text{T}$  with a velocity of  $2 \times 10^6 \text{ m/s}$  making an angle of angle of  $30^\circ$  with the direction of field. Find the force on the particle.
13. Obtain the de-Broglie wavelength of an electron of kinetic energy 100eV. Mass of electron =  $9.1 \times 10^{-31} \text{kg}$ ,  $e = 1.6 \times 10^{-19} \text{C}$ , and  $h = 6.6310^{-34} \text{Js}$ .

## **List of Experiments**

**(At least 10 experiments must be performed. )**

19. To determine the acceleration due to gravity of a place using simple pendulum. Hence determine the length of second pendulum.
20. To determine the Young's modulus of elasticity of a given wire using Vernier method.
21. To determine the surface tension of water using Capillary tube method.
22. To determine the coefficient of viscosity of a given liquid using Stoke's method.
23. To determine the melting point of wax using cooling curve method.
24. To determine the specific heat of solid capacity by the method of mixture.
25. To determine the specific heat capacity of liquid using cooling method.
26. To determine the coefficient of linear expansion using Pullinger's method.
27. To determine the magnetic moment and pole strength of a given magnet using deflection magnetometer.
28. To determine the angle of dip of a place using Dip Circle.
29. To determine the frequency of a tuning fork using sonometer.
30. To determine the frequency of AC mains using sonometer.
31. To determine the velocity of sound at room temperature using resonance air column method. Hence find the end correction.
32. To determine the resistivity of a given resistor using P.O. Box.
33. To compare the emf of two cells using Potentiometer.
34. To determine the high resistance of a given sample using substitution method.
35. To determine the capacitance of a capacitor using half life method.
36. To study the characteristics curves of a junction Diode.