

1.3 APPLIED PHYSICS – I

L T P
4 - 2

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects will behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content.

Note:- Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles.

DETAILED CONTENTS

1. Units and Dimensions (8 hrs)
 - 1.1 Physical quantities
 - 1.2 Units - fundamental and derived units, systems of units (FPS, CGS, MKS and SI units)
 - 1.3 Dimensions and dimensional formulae of physical quantities
 - 1.4 Dimensional equations and principle of homogeneity, applications to conversion from one system of units to another, checking the correctness of physical relations and derivation of simple physical relations, limitations of dimensional analysis
 - 1.5 Error in measurement, random and systematic errors, types of errors, propagation of errors, significant figures

2. Force and Motion (12 hrs)
 - 2.1 Concept of Scalar and Vector quantities – examples, types of vectors.
 - 2.2 Resolution and Composition of vectors, Vector multiplication (scalar product and vector product of vectors), addition of vectors (Parallelogram law)
 - 2.3 Force: Newton's laws of motion, linear momentum and conservation of linear momentum, impulse and its application, simple numerical problem in brake system of vehicles and trains etc.
 - 2.4 Friction: Types of friction and its application.
 - 2.5 Circular motion: Angular displacement, angular velocity and angular acceleration
 - 2.6 Relation between linear and angular variables (velocity and acceleration)
 - 2.7 Centripetal force (derivation) and centrifugal force with application such as banking of roads and bending of cyclists
 - 2.8 Application of various forces in lifts

- 3 Rotational Motion (6 hrs)
- 3.1 Concept of translatory and rotating motion with examples
 - 3.2 Definitions of torque, angular momentum and their relationship
 - 3.3 Conservation of angular momentum (qualitative) and its examples
 - 3.4 Moment of inertia and its physical significance, radius of gyration, Theorems of parallel and perpendicular axes (statements), Moment of inertia of rod, disc, ring and sphere (Formulae only).
 - 3.5 Application of rotational motions in transport vehicles, trains and aero plane turbine/engine.
- 4 Work, Power and Energy (8 hrs)
- 4.1 Work: definition and its SI units
 - 4.2 Work done in moving an object on horizontal and inclined plane (incorporating frictional forces) with its application
 - 4.3 Power: definition and its SI units, calculation of power with numerical problems
 - 4.4 Energy: Definition and its SI units: Kinetic energy and Potential energy with examples and their derivation
 - 4.5 Principle of conservation of mechanical energy (for freely falling bodies), transformation of energy from one form to another with its application
- 5 Properties of Matter (10 hrs)
- 5.1 Elasticity: definition of stress and strain, different types of modulus of elasticity, stress – strain diagram, Hooke's law with its applications
 - 5.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications
 - 5.3 Surface tension: concept, its units, angle of contact, measurement of surface tension by capillary tube method, applications of surface tension, effect of temperature and impurity on surface tension

- 5.4 Viscosity and coefficient of viscosity: Stoke's Law and derivation of terminal velocity, effect of temperature on viscosity.
- 6 Thermometry (10 hrs)
- 6.1 Difference between heat and temperature
- 6.2 Principles of measurement of temperature and different scales of temperature and their relationship
- 6.3 Types of thermometers (Concept only)
- 6.4 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
- 6.5 Modes of transfer of heat (Conduction, convection and radiation with examples)
- 6.6 Co-efficient of thermal conductivity
- 6.7 Engineering Application of conduction, convection and radiations
7. Waves and Vibrations (10 hrs)
- 7.1 Simple Harmonic Motion(SHM): definition, expression for displacement, velocity, acceleration, time period, frequency in S.H.M. Equation of simple harmonic progressive wave
- 7.2 Wave motion: transverse and longitudinal wave motion with examples, sound and light waves, velocity, frequency and wave length of a wave (relationship $v = n\lambda$) and their applications
- 7.3 Free, forced and resonant vibrations with examples
- 7.4 Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time and their applications
- 7.5 Ultrasonics – production (magnetostriction and piezoelectric methods) and their engineering and medical applications

LIST OF PRACTICALS (to perform minimum ten experiments)

1. To find the diameter of wire using a screw gauge
2. To find volume of solid cylinder and hollow cylinder using a vernier calipers

3. To determine the thickness of glass strip and radius of curvature using a spherometer
4. To verify parallelogram law of forces
5. To find the time period of a simple pendulum and determine the length of second's pendulum.
6. To find the frequency of a tuning fork by a sonometer
7. To find the velocity of sound by using resonance apparatus at room temperature.
8. To find the Moment of Inertia of a flywheel about its axis of rotation
9. To find the surface tension of a liquid by capillary rise method
10. To determine the atmospheric pressure at a place using Fortin's Barometer
11. To determine the viscosity of glycerin by Stoke's method
12. To determine the coefficient of linear expansion of a metal rod

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics of mechanics, work power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. **Use of demonstration can make the subject interesting and develop scientific temper in the students.**

RECOMMENDED BOOKS

1. Text Book of Physics for Class XI (Part-I, Part-II) N.C.E.R.T
2. Text Book of Physics for Class XII (Part-I, Part-II) N.C.E.R.T
3. Applied Physics Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, New Delhi
4. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
5. Berkeley Physics Course, Vol. I, II & III, Tata McGraw Hill, Delhi
6. Comprehensive Practical Physics, Vol. I & II, JN Jaiswal, Laxmi Publishers
7. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
8. Applied Physics I & II by RA Banwait & R Dogra, Eagle Parkashan, Jalandhar
9. Applied Physics by Jasmer Kaur and Bhupinder Singh, Lords Publications, Jalandhar City
10. Engineering Physics by Vanchna Singh and Sheetal Kumar, Cengage Learning India Pvt. Ltd. Patparganj, Delhi (year 2008)

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING PAPER SETTER

Sr No	Topic	Time Allotted (Hrs)	Marks Allotted (%)
1	Units and Dimensions	08	15
2	Force and Motion	12	20
3	Rotational Motion	06	10
4	Work, Power and Energy	08	10
5	Properties of Matter	10	15
6	Thermometry	10	15
7	Waves and Vibrations	10	15
	Total	64	100