

1.3 APPLIED PHYSICS-I

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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 technical fields are given prominence in the course content.

COURSE OUTCOMES

After completing this course, student should be able to:

- CO1: Identify physical quantities, select their units and make measurements with accuracy.
- CO2: Represent physical quantities as scalar and vector and identify type of motions, various forms of energy, their conversion and applications.
- CO3: Elaborate scientific work, energy and power, forms of friction and solve problems related to them.
- CO4: Comprehend properties of matter and effect of temperature on various matter and phenomenon.
- CO5: Demonstrate the use of physical principles and analysis in various technical fields.

DETAILED CONTENTS

UNIT I

Unit and Dimensions

- 1.1 Definition of Physics, physical quantities- fundamental and derived
- 1.2 Units: fundamental and derived
- 1.3 System of units: CGS, FPS, MKS, SI
- 1.4 Dimension, dimensional formulae and SI units of physical quantities-distance, displacement, area, volume, density, velocity, acceleration, linear momentum, force, impulse, work, power, energy, pressure, surface tension, stress, strain)
- 1.5 Dimensional equations, principle of homogeneity of dimensional equation
- 1.6 Application of dimensional analysis: checking the correctness of physical equation, conversion of system of unit (force, work, acceleration)

UNIT II

Force and Motion

- 2.1 Scalar and vector quantities– definition and examples, representation of vector, types of vector (unit vector, position vector, co-initial vector, collinear vector, co-planar vector)
- 2.2 Vector algebra- addition of vectors, Triangle & Parallelogram law (statement and formula only),
- 2.3 Scalar and vector product (statement and formula only)
- 2.4 Force and its units, resolution of force (statement and formula only)
- 2.5 Newton's laws of motion (statement and examples)
- 2.6 Linear momentum, Law of conservation of linear momentum (statement and examples), Impulse
- 2.7 Circular motion: definition of angular displacement, angular velocity, angular acceleration, frequency, time period; Relation between linear and angular velocity, centripetal and centrifugal forces (definition and formula only), application of centripetal force in banking of road
- 2.8 Rotational motion: definition with examples
- 2.9 Definition of torque, angular momentum, moment of inertia and its physical significance

UNIT III

Work, Power and Energy

- 3.1 Work- definition, symbol, formula and SI unit, types of work (zero work, positive work and negative work) with example
- 3.2 Friction– definition and its simple daily life applications
- 3.3 Power- definition, formula and units
- 3.4 Energy- definition and its SI unit, examples of transformation of energy.
- 3.5 Kinetic energy- definition, examples, formula and its derivation
- 3.6 Potential energy- definition, examples, formula and its derivation
- 3.7 Law of conservation of mechanical energy for freely falling bodies (with derivation)
- 3.8 Simple numerical problems based on formula of Power and Energy

UNIT IV

Properties of Matter

- 4.1 Elasticity and plasticity- definition, deforming force, restoring force, example of elastic and plastic body
- 4.2 Definition of stress and strain, Hooke's law, modulus of elasticity

- 4.3 Pressure- definition, atmospheric pressure, gauge pressure, absolute pressure, Pascal's law
- 4.4 Surface tension- definition, SI unit, applications of surface tension, effect of temperature on surface tension
- 4.5 Viscosity: definition, unit, examples, effect of temperature on viscosity

UNIT V

Heat and Temperature

- 5.1 Definition of heat and temperature (on the basis of kinetic theory)
- 5.2 Difference between heat and temperature
- 5.3 Principle and working of mercury thermometer
- 5.4 Modes of transfer of heat- conduction, convection and radiation with examples.
- 5.5 Properties of heat radiation
- 5.6 Different scales of temperature and their relationship

PRACTICAL EXERCISES

- 1. Familiarization of measurement instruments and their parts (for example – Vernier caliper, screw gauge, sphere meter, travelling microscope etc.), and taking a reading. (compulsory to all students)
- 2. To find diameter of solid cylinder using a Vernier caliper
- 3. To find internal dia meter and depth of a beaker using a Vernier caliper and hence find its volume.
- 4. To find the diameter of wire using screw gauge
- 5. To find thickness of paper using screw gauge.
- 6. To determine the thickness of glass strip using a spherometer
- 7. To determine radius of curvature of a given spherical surface by a spherometer.
- 8. To verify parallelogram law of force
- 9. To determine the atmospheric pressure at a place using Fortin's Barometer
- 10. To determine force constant of spring using Hooke's law
- 11. Measuring room temperature with the help of thermometer and its conversion in different scale.

RECOMMENDED BOOKS

- 1. "Text Book of Physics for Class XI (Part-I, Part-II)", N.C.E.R.T., Delhi.
- 2. Dr.HH Lal, "Applied Physics, Vol.I and Vol.II", TTTI Publications, Tata McGraw Hill, Delhi.

3. AS Vasudeva, “Applied Physics – I”, Modern Publishers, Jalandhar.
4. R A Banwait, “Applied Physics – I”, Eagle Prakashan, Jalandhar.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/ NITTTR.
6. C. L. Arora, “Practical Physics”, S Chand Publication.

SUGGESTED WEBSITES

1. <http://swayam.gov.in>
2. The Physics Classroom
3. <https://www.khanacademy.org/science/physics>

INSTRUCTIONAL STATREGY

This is hands-on practice based subject and topics taught in the class should be practiced in the Lab regularly for development of required skills in the students. This subject contains five units of equal weightage.

Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. Students need to be exposed to use of different sets of units and conversion from one unit type to another. Software may be used to solve problems involving conversion of units. 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. 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. In all contents, SI units should be followed. Working in different sets of units can be taught through relevant software.