2.2 APPLIED PHYSICS - II

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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 to prepare students for various technical applications.

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1: Differentiate between types of waves and their motion.
CO2: Illustrate laws of reflection and refraction of light.
CO3: Demonstrate competency in phenomena of electrostatics and electricity.
CO4: Characterize properties of material to prepare new materials for various technical applications.
CO5: Demonstrate a strong foundation on Modern Physics to use at various technical applications.

DETAILED CONTENTS

UNIT I

Wave Motion and its Applications

1.1 Waves: definition, types (mechanical and electromagnetic wave).
1.2 Wave motion- transverse and longitudinal with examples, terms used in wave motion like displacement, amplitude, time period, frequency, wavelength, wave velocity; relationship among wave velocity, frequency and wave length.
1.3 Simple harmonic motion (SHM): definition, examples.
1.4 Cantilever: definition, formula of time period (without derivation).
1.5 Free, forced and resonant vibrations with examples

1.6 Sound waves: types (infrasonic, audible, ultrasonic) on the basis of frequency, noise, coefficient of absorption of sound, echo

UNIT II

Optics

2.1 Reflection and refraction of light with laws, refractive index.

2.2 Lens: introduction, lens formulae (no derivation), power of lens and simple numerical problems.

2.3 Total internal reflection and its applications, critical angle and conditions for total internal reflection.

2.4 Superposition of waves (concept only), definition of Interference, Diffraction and Polarization of waves.

2.5 Introduction to Microscope, Telescope and their applications.

UNIT III

Electrostatics and Electricity

3.1 Electric charge, unit of charge, conservation of charge.

3.2 Coulomb's law of electrostatics.

3.3 Electric field, electric lines of force (definition and properties), electric field intensitydue to a point charge.

3.4 Definition of electric flux, Gauss law (statement and formula).

3.5 Capacitor and capacitance (with formula and unit).

3.6 Electric current and its SI Unit, direct and alternating current.

3.7 Resistance, conductance (definition and unit).

3.8 Series and parallel combination of resistances.

3.9 Ohm's law (statement and formula).

UNIT IV

Classification of Materials and their Properties

4.1 Definition of energy level, energy bands.

4.2 Types of materials (conductor, semiconductor, insulator and dielectric) with examples, intrinsic and extrinsic semiconductors (introduction only).

4.3 Introduction to magnetism, type of magnetic materials: diamagnetic, paramagnetic and ferromagnetic materials with examples

4.4 Magnetic field, magnetic lines of force, magnetic flux

4.5 Electromagnetic induction (definition)

UNIT V

Modern Physics

5.1 Laser: introduction, principle, absorption, spontaneous emission, stimulated emission, population inversion

5.2 Engineering and medical applications of laser

5.3 Fibre optics**:** introduction to optical fibers (definition, principle and parts), light propagation, fiber types (mono-mode, multi-mode), applications in medical, telecommunication and sensors

5.4 Nanotechnology: introduction, definition of nanomaterials with examples, properties at nanoscale, applications of nanotechnology (brief)

PRACTICAL EXERCISES

1. Familiarization with apparatus (resistor, rheostat, key, ammeter, voltmeter, telescope, microscope etc.)
2. To find the time period of a simple pendulum.
3. To study variation of time period of a simple pendulum with change in length of pendulum.
4. To determine and verify the time period of Cantilever.
5. To verify Ohm's laws by plotting a graph between voltage and current.
6. To study colour coding scheme of resistance.
7. To verify laws of resistances in series combination.
8. To verify laws of resistance in parallel combination.
9. To find resistance of galvanometer by half deflection method.
10. To verify laws of reflection of light using mirror.
11. To verify laws of refraction using glass slab.
12. To find the focal length of a concave lens, using a convex lens.

RECOMMENDED BOOKS

1. "Text Book of Physics for Class XII (Part-I, Part-II)", N.C.E.R.T., Delhi.
2. Dr. HH Lal, "Applied Physics, Vol. I & II", TTTI Publications, Tata McGraw Hill,Delhi.
3. AS Vasudeva, "Applied Physics –II", Modern Publishers, Jalandhar.
4. R A Banwait, "Applied Physics – II", Eagle Prakashan, Jalandhar.
5. N Subrahmanyam, Brij Lal and Avadhanulu, "A text book of OPTICS", S Chand Publishing, New Delhi.

6. E-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/NITTTR.
7. M H Fulekar, "Nanotechnology: Importance and Applications", IK InternationalPublishing House (P) Ltd., New Delhi.
8. C. L. Arora, "Practical Physics", S Chand Publication.

SUGGESTED WEBSITES

1. http://swayam.gov.in

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.