

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT BAME, BIE, B Agri.	Pass Marks	32
Year / Part	I / I	Time	3 hrs.

Subject: - Engineering Physics (SH402)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. Differentiate between bar pendulum and torsional pendulum. Prove that there exists four collinear points in bar pendulum.

OR

Prove that LC circuit is an analogy of simple harmonic motion and hence prove that maximum energy stored in electric field is equal to maximum energy stored in magnetic field.

2. In simple harmonic motion, when the displacement is one-half the amplitude, what fraction of the total energy is KE and what fraction is PE? At what displacement is the energy half KE and half PE?
3. A source of sound has a frequency of 256 Hz and amplitude of 0.50 cm, calculate the energy flow across a square cm per sec. The velocity of sound in air is 330 m/s and density of air is 1.29 kg/m³.
4. Prove that interference in thin film of reflected and transmitted light are complementary to each other.

OR

What is diffraction of light? Discuss the intensity distribution with special reference to diffraction of light in a single slit.

5. Two thin converging lenses of focal lengths 30 cm and 40 cm respectively are placed co-axially in air separated by a distance of 20 cm. An object is placed 40 cm in front of the first lens. Find the position and nature of the image.
6. A 200 mm long tube and containing 48 cm³ of sugar solution produces an optical rotation of 11° when placed in a saccharimeter. If the specific rotation of sugar solution is 66°, calculate the quantity of sugar contained in the tube in the form of a solution.
7. In a Newton's ring experiment the diameter of the 10th ring changes from 1.40 cm to 1.27 cm when a liquid is introduced between the lens and the plate. Calculate the refractive index of the liquid.
8. What is an optical fiber? Show that Numerical aperture of an optical fiber is given by the expression, $NA = \mu \sqrt{2\Delta}$, where the symbols carry their usual meanings.
9. Determine the electric field at a distance z on the central axis from the center of a charged ring. Also, find the maximum value of electric field.

OR

Calculate the potential at any point due to an electric dipole. Also, find the potential on the axial line.

10. Over certain region of space the electric potential is $v = 15x - 3x^2y + 12yz^2$. Find the expression for the x, y and z components of the electric field over this region. What is the magnitude of the field at the point P that has coordinates (1, 0, -2) m?
11. Write the general methods to calculate the capacitance of a capacitor and hence determine the capacitance of a cylindrical capacitor of inner and outer radii 'a' and 'b' respectively.
12. Calculate the drift speed of electrons when 20 A current is supplied through a copper wire of cross-sectional area 1 mm^2 and electron density 10^{28} m^{-3} .
13. Determine the energy stored in an inductor. Hence, prove that the energy density in magnetic field is directly proportional to square of magnetic field.

OR

Obtain an expression for magnetic field intensity due to a circular coil carrying current at its axial point

14. A copper strip 3.0 cm wide and 2.0 mm thick is placed in a magnetic field 1.75T. If a current of 150 A is setup in the strip, calculate (i) Hall voltage and (ii) Hall mobility if the number of electrons per unit volume is $8.4 \times 10^{28} \text{ m}^{-3}$ and resistivity is $1.72 \times 10^{-8} \text{ ohm-m}$.
15. Define poynting vector. Prove that $\vec{S} = \frac{1}{\mu} (\vec{E} \times \vec{B})$
16. A beam of electrons having energy of 3eV is incident on a potential barrier of height 4 eV. If the width of the barrier is 20 \AA , calculate the percentage transmission of the beam through the barrier.
