

Engineering Physics
(PH-101, Dec-07)

Note: Section A is compulsory. Attempt any five questions from Section-B and C taking at least two questions from each Section.

Section-A

1. (a) Find the electric field strength for a uniform charge distribution.
- (b) What is polarization?
- (c) Define Coercive force and hysteresis.
- (d) Write the physical significance of Einstein Coefficients.
- (e) Define Holography.
- (f) Write the postulates of Einstein special theory of relativity.
- (g) State Bragg's law?
- (h) Distinguish between phase and group velocity.
- (i) State Meissner effect of superconductivity.
- (j) Define Acceptance angle and Numerical aperture in optical fibre.

Section-B

2. (a) Prove Gauss's law in integral form $\oint_s E \cdot ds = \frac{1}{\epsilon_0} \int \rho \cdot dv$. What do you mean by Gaussian surface. Derive Coulomb's law from Gauss's law.
- (b) Deduce Maxwell's equation for free space and prove that the electromagnetic waves are transverse in nature.
3. (a) Prove that the area of the B-H curve is $1/4\pi$ times the energy dissipated per cc of the metal during each magnetic cycle.
- (b) Find out the expression of magnetic moment due to orbital and spin motion of electron.
4. (a) Explain the action of He-Ne laser. How it is superior to Ruby laser?
- (b) In a Ruby laser, total number of Cr^{+3} ions is 2.8×10^{19} . If the laser emits radiation of wavelength 7000\AA , then calculate energy of one emitted photon and total energy available per laser pulse.
5. (a) Differentiate between Step-index and Graded-index fibre.
- (b) What will be the critical angle for a ray in a step-index fibre for which $n=1.53$ and which has a cladding whose refractive index is 2.5% less.

Section-C

6. (a) prove the relation $F=ma$ is covariant under relativistic transformation.
- (b) Show that the relativistic form of Newton's second law when F is parallel to v is

$$F = m_0 \frac{dv}{dt} \left(1 - \frac{v^2}{c^2} \right)^{-3/2}$$

7. (a) Explain why the continuous spectrum has a sharp point and short wavelength side?
- (b) In a x-ray energy 75 KeV is scattered at 45° , then calculate the energy of scattered x-ray.
8. (a) Prove Heisenberg's uncertainty principle. $\Delta h \cdot \Delta p \geq h/2$
- (b) If the energy of the particle is zero, then prove using quantum mechanics that it can not exist in a box.
9. (a) What is London's penetration depth? How does it vary with temperature?
- (b) Define Cooper pair.
Calculate the wavelength of photon, which will be required to break a Cooper-pair in a superconductor like Zr whose T_c is 0.56K.