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 $\oint_S E.ds = \frac{1}{\varepsilon_0}\int \rho.dv$ .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 7000Å, 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. $\Delta h.\Delta p \geq h/2$
   (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.