

**Engineering Physics**  
(PH-101, Dec.2005)

Time: 3 Hours

Max. Marks: 60

**Note:** Question No. 1 is compulsory. Attempt five questions from section A and B, taking at least two questions from each section.

**Section-A**

1. (a) What is dielectric polarization?  
(b) What are ferrites?  
(c) Can we obtain light amplification in absence of stimulated emission? Explain.  
(d) What are Einstein's coefficients? How are these co-related?  
(e) Define acceptance angle and numerical opertune.  
(f) Show that relativistic law of addition of velocities predicts value of velocity of light in all inertial frames.  
(g) What is the origin of X-rays? Explain.  
(h) What voltage must be applied to an electron microscope to produce electrons of wavelength of  $0.5 \text{ \AA}$ . Given  $h=6.62 \times 10^{-34} \text{ J-sec}$ ,  $e=1.6 \times 10^{-19} \text{ C}$  and  $m=9.1 \times 10^{-31} \text{ kg}$ .  
(i) What is the physical significance of a wave function?  
(j) What are cooper pairs?

**Section-B**

2. (a) Write maxwells equations. Explain the physical significance of each equation.  
(b) Using Gauss's law to find the electric field due to a uniformly charged solid sphere at a point which lies inside the sphere.
3. (a) Explain the following terms
  - i) Magnetic domain
  - ii) Magnetic anisotropy
  - iii) Magnetosriction  
(b) What is difference between soft and hard magnetic materials?
4. (a) Discuss the principle of operation of He-Ne laser. Draw the energy level diagram and indicate the wavelength of the radiation.  
(b) What is holography?
5. (a) Explain the difference between single mode and multi mode transmission in their fiber optics.  
(b) Calculate the max value of the angle of incidence that a ray can make with the axis of a fiber such that it is guided through the fiber for the following fiber parameters:  
(i)  $n_1 = 1.6$ ,  $n_2 = 1.5$       (ii)  $n_1 = 2.1$ ,  $n_2 = 1.5$

**Section-C**

6. (a) Explain the postulates of theory of relativity and derive lorentz transformation equation.  
(b) A certain process require  $10^{-6}$  sec to occur in an atom at rest in laboratory. How much time will this process to an observer in the laboratory, when the atom is moving with a speed of  $5 \times 10^7 \text{ m/s}$ ?
7. (a) Explain and deduce Bragg's law in X-ray diffraction. Describe Bragg's spectrometer and explain how it is used to determine the wave length of X-rays.  
(b) An x-ray tube works at 18 kv. Find the maximum speed of electron striking the anti-cathode.
8. (a) Discuss compton's scattering and derive a relation for change in wavelength of the scattered photon.  
(b) Explain briefly uncertainty principle.
9. What do you understand by type I and type II superconductors? Give the BCS theory of superconductivity.