

OCT-2015

B. Sc. Semester-V  
Physics Paper: 502 (code: 4295)  
(Electrostatic, Fiber Optics, X-ray)

Date:

[Time: 02:30 Hours]

[Total Marks: 70]

Instructions: (1) Symbols have their usual meaning.  
(2) Figures on right hand side show marks of that question.

1. (a) When a dielectric sphere is placed in a uniform electric field, showing diagram, calculate the electric field inside and outside the dielectric sphere. [10]  
(b) Explain the following terms: [04]  
(1) Isotropic and anisotropic dielectric.  
(2) Polar and non polar dielectric.

OR

1. (a) Define electric field intensity  $E$ , Polarization  $P$  and electric displacement Vector  $D$ . Establish relation between them. [10]  
(b) Consider an electric charge  $-e$  moving in a circular orbit of radius  $a_0$ , about charge  $+e$  in a field directed at right angles to the plane of the orbit. Show that the polarizability  $\alpha$  is approximately  $4\pi\epsilon_0 a_0^3$ . [04]
2. (a) Derive an expression for the numerical aperture of fiber optical system and explain acceptance cone. [12]  
(b) An optical fiber is made of glass with a refractive index of 1.54 and is clad with another glass with a refractive index 1.48. Light is launched from air. What is the value of numerical aperture and acceptance angle. [02]

OR

2. (a) Explain different types of fiber index profile. [10]  
(b) What is dispersion effect in fiber? Explain intermodal and Material Dispersion. [04]

3. (a) Explain incoherent scattering and derive equation for 'Compton shift'. [12]  
Obtain relationship between  $\theta$  and  $\phi$ .
- (b) The wavelengths of the K and  $L_2$  absorption edges of the copper are [02]  
 $1.3774 \text{ \AA}$  and  $12.9 \text{ \AA}$  respectively. What is the wavelength of  $K_{\alpha 2}$   
line of copper?

OR

3. (a) Discuss characteristic absorption X-ray spectrum with graph of mass [07]  
absorption co-efficient of the material ( $\mu/\rho$ ) against the wavelength ( $\lambda$ ).
- (b) Explain an Auger effect. [07]
4. (a) Discuss the behavior of point charge in dielectric medium and shows [08]  
that the electric field in a dielectric is smaller than when medium were  
absent.
- (b) Give the application of X-rays. [06]

OR

4. (a) Write "Moseley's law" and explain it on the basis of the Bohar model [08]  
for the atom.
- (b) What is the difference between optical spectra and X-ray spectra? [06]
5. (a) Describe various modes of prorogation of the wave in optical fiber. [10]
- (b) Calculate the induced dipole moment per unit volume of helium gas [04]  
placed in an electric field of  $5 \times 10^5 \text{ volt/m}$ . The molecular polarizability  
is  $2.30 \times 10^{-41} \text{ farad.m}^2$  and the density of helium is  $20.5 \times 10^{25}$   
molecules/ $\text{m}^3$ .

OR

5. (a) Write note advantages of optical fiber. [07]
- (b) Explain coherent scattering and derive equation for total scattered [08]  
intensity.

