

Third Year B.Sc. Examination

Physics: Paper-302

(New Course)

(Electrostatics, Electrodynamics, Laser, Fiber Optics, X-rays)

Time: 2 Hours]

[Total Marks: 75

Paper code → 8938

Instructions:

- (i) Symbols have their usual meaning.
(ii) Figures on right hand side show marks of that question.

Q:1 [a] Find potential and electric field inside and outside the sphere of radius R. [12]

[b] Explain relative permittivity of the medium. [03]

[c] The polarization of NH_3 molecule is found approximately by the measurement of dielectric constant as $2.42 \times 10^{-39} \text{ Coulomb}^2 \cdot \text{m} \cdot \text{newton}^{-1}$ and $1.74 \times 10^{-39} \text{ Coulomb}^2 \cdot \text{m} \cdot \text{newton}^{-1}$ at 309 K and 448 K respectively, Calculate the Polarizability due to permanent dipole moment and due to deformation of molecules for each temperature. [04]

OR

Q:1 [a] For a current element, derive Ampere's Force law. [06]

[b] For magnetic induction (\vec{B}) prove that $\vec{\nabla} \times \vec{B} = \mu_0 \vec{j}$ [11]

[c] Define the following terms :

Polar dielectric and Non polar dielectric. [02]

Q:2 [a] Write Maxwell's equation for free space in differential form. [04]

[b] For homogeneous, isotropic, linear, source free and stationary conducting media derive equation of wave propagation. [08]

[c] Prove that the normal component of magnetic induction is continuous across boundary. [07]

OR

Q:2 [a] Show that the wave equation can be written in the form : $(\nabla^2 + K^2) \vec{E} = 0$ [04]
where K is wave vector.

[b] Discuss the propagation of electromagnetic waves in ionized gases and obtain the condition of wave propagation in ionized media. [11]

[c] For an electromagnetic wave propagating in ionized region, prove that the plasma frequency $f_p = 8.98 \sqrt{N}$, where N = No of electrons per unit volume. [04]

Q:3 [a] Derive an expression for Einstein's co-efficient A_{21} and B_{21} , and explain the conditions of stimulated emission. [12]

[b] Explain in detail population inversion with three level scheme. [07]

OR

Q:3 [a] Describe in brief the application of LASER in Holography.. [07]

[b] Write a note on Auger effect. [04]

[c] Explain Construction and working of Semiconductor LASER. [08]

Q:4 [a] Derive an expression for the numerical aperture (N.A.) Explain the acceptance angle and acceptance cone. [11]

[b] Explain fiber index profile in detail. [07]

OR

Q:4 [a] Write a short note on optical fiber losses. [11]

[b] Explain dispersions in optical fiber. [07]