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Total No. of Pages : 02

Total No. of Questions : 18

B.Tech. (CHS) (2018 & Onwards) (Sem.-1,2)

**OPTICS & ELECTROMAGNETISM**

Subject Code : BTPH-106-18

M.Code : 75366

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

**SECTION-A**

**Write briefly :**

1. What do you mean by double refraction?
2. Write a note on optical activity.
3. Differentiate between spontaneous and stimulated emission.
4. Explain the term 'Population Inversion'.
5. Explain 'Numerical Aperture'.
6. What are the limitations of Coulomb's law?
7. Write the necessary conditions for a wave function to exist.
8. Discuss the significance of de Broglie hypothesis.
9. Find the de Broglie wavelength of an electron moving with velocity  $10^7 \text{ ms}^{-1}$ .
10. Discuss the Faraday's law of electromagnetic induction.

**SECTION-B**

11. a) Deduce the missing orders for a double slit fraunhofer diffraction pattern, if the slit widths are 0.16 mm and they are 0.8 mm apart. (2)  
b) Explain the formation of spectra by plane diffraction grating. What are its main characteristics? (6)

12. Distinguish between plane polarized, circularly polarized and elliptically polarized light. How can circularly and elliptically polarized lights be produced. Explain briefly how will you determine whether a beam of light is unpolarized, plane polarized, circularly polarized and elliptically polarized? (8)
13. a) What are the components of optical communication. Why optical fiber is considered as best channel for optical communication? Describe the types of optical fibers. (6)
- b) An optical fiber has a core material of refractive index of 1.55 and cladding material of refractive index 1.50. The light is launched into the fiber from air. Calculate its numerical aperture. (2)
14. a) Describe the construction and working of a He-Ne laser with necessary diagram. (6)
- b) Find the relative populations of the two states in a ruby laser that produces a light beam of wavelength 6943 Å at 300K. (2)

### SECTION-C

15. a) An infinitely long wire has linear charge density  $2 \times 10^{-6}$  C/m. calculate the intensity of the electric field at a point 10 cm normal to the length of the wire. (3)
- b) Explain the use of hysteresis curve. What type of magnetic material is suitable for transformer cores, telephone diaphragm and chokes. (5)
16. a) Derive Clausius-Mossotti equation for non-polar dielectrics. (5)
- b) Calculate the induced dipole moment per unit volume of He gas if placed in a field of 6000 V/cm. the atomic polarisability of He is  $0.18 \times 10^{-40}$  farad m<sup>2</sup> and density of He is  $2.6 \times 10^{25}$  atoms per m<sup>3</sup>. Also calculate the separation between the centres of positive and negative charges. (3)
17. State Schrodinger's wave equation for a free particle in one dimensional closed box with infinitely hard walls. State the boundary conditions and solve it to obtain the normalized wave function for the particle. (8)
18. a) Describe with necessary theory Davisson and Germer experiment for establishing wave nature of the electron. (6)
- b) What is the effect of increasing the electron energy on the scattering angle in Davisson and Germer experiment? (2)

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**