Summer Term Examination (2018-19)

B.Tech. I year

Engineering Physics (BPHS0001/AHP1101)

Time: 3 Hours **Max.Marks: 80**

SECTION A

Note: Attempt all questions from section A. **2×10 = 20**

1. Two waves each of intensity 2 units interfere with phase difference of $\pi/2$. Find the resultant intensity at a point where these waves are superposing.
2. What are coherent sources? Explain briefly why two independent light sources can not be coherent?
3. What is meant by diffraction of light? Mention the condition to get the best diffraction pattern of an obstacle?
4. 10 gram sugar is dissolved in 100 cc water and is placed in a tube of length 2 dm. If the specific rotation of the sugar solution is $65^0 dm^{-1} gm^{-1} cc^{-1}$ then find the optical rotation produced by it.
5. Write the Maxwell's equations in integral form.
6. Kinetic energy of a partcle is two times of its rest mass energy. Calculate the velocity of this particle.
7. The mobility of electrons in an N-type semiconductor is 0.4 m^2/vsec. Calculate the electric field required to produce a drift velocity of 40 m/sec in the electrons.
8. What is wavefunction? Descibe its physical sinificance.
9. Explain Meissner effect and show that superconductors behave as perfect diamagnetic materials below or at critical temperature.
10. A proton having rest mass (m_0) =1.67×10^{-27} kg is moving with velocity 0.6c. Compute the wavelength of matter wave associated with it.

SECTION B

PART – I

Note: Attempt any two questions. **5 × 2 = 10**

1. Light rays from two coherent sources are superposing with each other in Young's double slit experiment. Obtain the expressions for the position of bright and dark fringes in the intereference pattern. Also explain the shape of these fringes.

2. What is a plane transmission grating? Derive the expression for the resultant intensity due to diffraction from it. Using this expression also find out the angular positions of princpal maxima.
3. Discuss about the phenomenon of double refraction. Mention the salient features of ordinary and extra-ordinary rays.

PART – II

Note: Attempt any two questions. $5 \times 2 = 10$

1. What are intrinsic semiconductors? Explain the need of doping in them. Derive the expression of temperature dependent conductivity for an intrinsic semiconductor.
2. What is Hall effect? Find the expression for Hall coefficient in terms of Hall voltage.
3. Deduce the equation of continuity. How does it represent the law of conservation of charge?

PART- III

Note: Attempt any two questions. $5 \times 2 = 10$

1. Obtain the expression for time dilation. Proper life of a particle is 2×10^{-6} sec. Find the life of particle in a frame with respect to which it is moving with the speed 0.8c.
2. Define matter waves. A particle (rest mass = m_0) having kinetic energy K is moving relativistically. Find the wavelength of matter wave associated with it in terms of its kinetic energy and rest mass energy.
3. Obtain Bragg's equation for diffraction from crystal planes. Calculate the longest wavelength that can be analysed by the rock salt crystal for which distance between inter atomic planes is 2Å in the first order.

SECTION C

Note: Attempt all questions (Internal choice is given in each question). $10 \times 3 = 30$

1. Explain the formation of Newton's rings. Derive the expression for the diameter of n^{th} bright ring. How the refractive index of a liquid is determined using Newton's ring experiment?

OR

Discuss the superposition of ordinary and extra ordinary rays having perpendicular vibrations and deduce the equation of the trajectory of the resultant light vector. Also mention the conditions for phase

difference between ordinary and extra ordinary rays for getting the circularly and elliptically polarised lights.

2. Define mobility. Obtain the expression for the conductivity of semiconductor in terms of number of charge carriers, their mobility and electronic charge. Pure silicon is dopped with 10^{19} phosphorous atoms. Find its conductivity if the mobility of electrons is $0.45 m^2/V\text{-}Sec$.

OR

What do you understand by Poynting vector? Derive the mathematical form of the Poynting theorem and give the physical interpretation of each term involved in it. Earth receives 1400 joule $sec^{-1}m^{-2}$ solar energy. Calculate the average strength of electric and magnetic fields received at earth surface.

3. Derive the time independent and time dependent Schrodinger's wave equations. Also write these equations for a free particle.

OR

Obtain the relativistic velocity transformation equations. Using these equations show that no signal can exceed the speed of light. Two particles are approaching towards each other with the speed 0.9c. Find their relative speed.

Physical Constants

Speed of light (c) = 3×10^8 m/sec
Plank's constant (h) = 6.63×10^{63} Joule – sec
Electronic charge (e) = 1.6×10^{-19} Coulomb
Pearmeability of free space (μ_0) = $4\pi \times 10^{-7}$ N/Amp^2
Permittivity of free space (ϵ_0) = 8.85×10^{-12} $C^2 N^{-1} m^{-2}$