End Term Examination, Even Semester 2018-19
B. Tech, I-Year, II Semester
Engineering Physics (BPHS 0001)

Time: 3 Hours   Total Marks: 50

Section - A

Note: Attempt all questions. $7 \times 5 = 35$

1. State the essential conditions for obtaining the sustainable interference of light. Explain the formation of Newton Rings in reflected monochromatic light and prove that the diameters of dark rings are proportional to the square roots of natural numbers.

2. In Young's double slit experiments, the slits are 0.5 mm apart and interference is observed on a screen placed at a distance of 100 cm from the slits. It is found that the 9th bright fringe is at a distance of 8.5 mm from the 2nd dark fringe from the center pattern. Find the wavelength of light used.

3. Explain the phenomenon of diffraction of light? Show that the intensity of principal maxima obtained due to diffraction grating is proportional to N^2 where N is the number of parallel slits in grating.

Or

What is meant by plane polarized light? Obtain the general equation of polarization of light obtained due to the superposition of two plane polarized light waves travelling in the same direction when their optical vectors are mutually perpendicular.

4. Explain Hall effect and obtain the expression for Hall coefficient. What does Hall coefficient signify?

5. Explain the concept of displacement current. How does Ampere's circuital law is modified in view of displacement current? Determine the conduction current and displacement current densities in a material having conductivity of 10^{-4} siemen / meter

and relative permittivity $\varepsilon_r=2.25$. The electric field in the material is $E=5\times10^{-6} \sin (9\times10^9 t)$ volt/meter. $(\varepsilon_0=8.85\times10^{-12})$

6. What do you mean by a massless particle? Explain. Deduce the Einstein mass-energy relation. Calculate the relativistic energy of an electron moving with speed of $0.8c$.

7. Discuss Compton Effect and derive appropriate expression for the change in wavelength of a photon when it is scattered by a free electron. Calculate the value of Compton wavelength.

OR

Define Heisenberg's uncertainty principle. Using this principle, find the radius of Bohr's first orbit in an atom

Section-B

Attempt all questions.   **2x3=6 Marks**

1. Derive the expression for length contraction.
2. Calculate the de-Broglie wavelength associated with an electron and a proton of 1 MeV energy each.
3. How fast an electron move in order that its mass is equal to the rest mass of the proton?

Attempt all questions.   **3x3=9 Marks**

1. Show that the group velocity is equal to the particle velocity associated with matter waves.
2. Define the group velocity and phase velocity of matter wave. Establish a relation between group velocity and phase velocity of the matter wave applicable in a dispersive medium.
3. Drive time independent Schrodinger wave equation. Give the physical interpretation of the wave function used in this equation.

Physical Constants

Plank's constant $(h) = 6.63 \times 10^{-34}$ joule – sec.
Permittivity of free space $(\varepsilon_0) = 8.85 \times 10^{-12}$ Coul.^{2}/ Nm^2
Rest mass of electron $= 9.1 \times 10^{-31}$ kg
Rest mass of proton $= 1.6 \times 10^{-27}$ kg