Dr Vimal Sharma . 21/6/2023

M (6)

National Institute of Technology Hamirpur

End-Semester Examination

2nd Semester, Engineering Physics (PH-101)

Time: 3 Hrs. **MM: 50**

Note: Attempt all the given questions.

Section A

Question 1 Describe Fermi distribution function and its variation with temperature. (2)

Question 2 How light interacts with matter? Under normal conditions write variation of intensity of light with distance travelled through the matter. (2)

Question 3 Define (i) Acceptance angle
(ii) V-number and
(iii) Cut-off frequency for an optical fibre. (2)

Question 4 Describe and draw critical magnetic field (H_c) versus temperature (T) graph for a type-II superconductor. (2)

Question 5 Prove that energy densities associated with electric and magnetic fields in electromagnetic waves are equal. (2)

Section B

Question 6 Derive expression for Density of States starting from particle in three dimensional box and also plot density of states with wave number k. (5)

Question 7 Neglecting spontaneous emission and considering only stimulation emission and absorption derive the expression for the gain factor for propagation of light through the material medium. (5)

Section C

Question 8 A typical He-Ne laser emits radiation of λ = 6328A. How many photons per second would be emitted by a one mW He-Ne laser? (5)

Question 9 Define Poynting vector and drive its expression in terms of electric and magnetic fields.(5)

Question 10 Use Maxwell's equations for deriving wave equation for electromagnetic waves travelling through conducting isotropic medium and how amplitude of electromagnetic wave varies with propagation of the wave in the medium. (5)

Section D

Question 11 Define superconductivity, critical temperature and critical magnetic field. Explain Meissner's Effect and show with experimental illustrations that Meissner's effect is only shown by superconductors and not by perfect conductors. (5)

Question 12 State the requirement of Schrödinger's wave function and drive time independent Schrödinger equation for a particle moving in a finite potential V. (5)

Question 13 Calculate the de-Broglie wavelength of a proton whose kinetic energy is equal to the rest energy of an electron. Mass of proton is 1836 times greater than that of an electron. (5)