MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : BS-PH101/BSPH101 Physics-I
UPID : 001003

Time Allotted : 3 Hours *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question) [1 x 10 = 10]

1. Answer *any ten* of the following :
   (i) What is the emissivity of an ideal black body?
   (ii) What is the dimension of phase space?
   (iii) The Curl of a conservative vector field is _____.
   (iv) In Fraunhofer diffraction, the incident wavefront is _____
   (v) The displacement current arises due to _____.
   (vi) For an ideal blackbody, the power emitted per unit area is proportional to _____.
   (vii) At absolute zero temperature what is the probability of occupancy of an electron in an energy state above the Fermi level?
   (viii) Find the angle between the vectors $\hat{i}$ and $2\hat{i} + \hat{j}$
   (ix) Diffraction is actually a form of interference. True or False?
   (x) Dimension of polarizability in SI units is ____
   (xi) If E_1 be the energy of the ground state of a 1 dimensional potential well of length L and E_2 be the energy of the ground state of a 1 dimensional potential well of length L/2, what is the relation between E_1 and E_2?
   (xii) What is the average energy of electrons in a metal at 0 Kelvin?

Group-B (Short Answer Type Question) [5 x 3 = 15]

Answer *any three* of the following :

2. State five applications of LASER [5]
3. Mention the criteria for the applicability of Bose-Einstein statistics. [5]
4. FInd the value of the given Commutator and explain the significance of the result [5]

$$[\hat{x}, \widehat{p_x}]$$

5. What do you mean by Macrostate and Microstate? –Explain with suitable example. [5]
6. Compute the smallest possible uncertainty in the position of an electron moving with speed 30000000 metres per second. [5]

Group-C (Long Answer Type Question) [15 x 3 = 45]

Answer *any three* of the following :

7. (a) Give one example of Solid, Liquid and Gaseous Dielectric material [3]
   (b) State three applications of Dielectric Materials [3]
   (c) What is Dielectric Constant? What is its value in vacuum and conductor? [2+1+1]
   (d) A capacitor is made up of a dielectric material of ϵ_r=4.2. It has an effective surface area of 0.09m^2 and capacitance of 10μF. Calculate the field strength if a potential difference of 5V exists across the capacitor. Given ϵ_0=8.85^(-12) Fm^{-1} [5]
8. (a) State the Planck's radiation law explaining all terms and show that the law reduces to the Wien's radiation law and Rayleigh Jeans law in opposite limits. [2+2+2]
   (b) Define group velocity and Phase velocity. Show that the product of group velocity and phase velocity is a constant. [2+3]

(c) Write down the time dependent Schrodinger equation clearly mentioning the terms. Explain the physical significance of a wave function [2+2]

9. (a) A particle is executing simple harmonic oscillation and has a velocity of 5m/s when the displacement is 2m and reduces to 2m/s when the displacement is 5m. Calculate [4+2+2]
   i) Amplitude
   ii) Frequency
   iii)Time period
   of the above oscillation

   (b) Define holonomic and non holonomic Constraints with examples of each [2+2]

   (c) What is a conservative vector field? Give one example [2+1]

10. (a) Compare diamagnetic, paramagnetic and ferromagnetic materials [6]

    (b) Differentiate between Soft and Hard magnetic materials [3]

    (c) The value of permeability of a material is 0.12 N/A2. What is the relative permeability and magnetic susceptibility? [2+2]

    (d) Define magnetic domain of ferromagnetic materials. [2]

11. (a) Find the minimum number of lines of a grating which can resolve in the second order spectrum of two lines having wavelengths 5890 Angstrom and 5896 Angstrom. [5]

    (b) Two polarisers are placed at crossed position. At what angle should a third polariser be placed so that the intensity of the emergent light is one-fourth of the intensity of incident light? [5

    (c) What is the highest order spectrum which may be observed with monochromatic light of wavelength 200 nm by using a grating with 2000 lines/cm [

*** END OF PAPER ***