POSSESION OF MOBILES IN EXAM IS UFM PRACTICE.

Enrollmen

: Institute of Information Technology, Noida
T3 Examination, 2014
B.Tech II Semester

Course Title : Physics II | **Maximum Time : 2 hrs**
Course Code : 10B11PH211 | **Maximum Marks : 35**

1. (a) Can a charge free region be associated with the electric potential $V=x^2+y^2+z^2$ (volts)?
(b) Using uncertainty principle, establish that absolute zero temperature is not reachable.
(c) Write the normalized wave function of a particle confined in a box of dimension L_x , L_y and L_z.
(d) Which of the radiation X-rays or visible light is used to determine the crystal structure of crystalline solid. Why?
(e) Calculate <x> for the following wave function $\psi_1 = \sqrt{\frac{2}{L}}\sin\frac{\pi x}{L}$ for $-\frac{L}{2} \le x \le \frac{L}{2}$ **(5×1)**

2. (a) A long cylinder carries a uniform charge density ρ_o . Calculate the electric field everywhere.

(b) The pressure exerted by EM radiation on a perfect absorber is 35.4 N/m^2. Calculate the amplitude of electric and magnetic field. **(3+2)**

3. (a) Two Carnot engines A and B are operated in series. The first one A, receives heat at 800K and rejects heat to reservoir at temperature **T**. The second engine B receives the heat rejected by the first engine and in turn rejects heat to a reservoir at 200K. Calculate the temperature T when (i) the work outputs of the two engines are equal and (ii) the efficiencies of the two engines are equal.

(b) A step index fiber has a core refractive index 1.466, cladding refractive index 1.46. If the operating wavelength of the rays is 0.85 μm, calculate the cut-off parameter and the number of modes which the fiber will support. The diameter of the core is 50 μm. **(3+2)**

4. (a) Sketch the wave function and probability density of linear harmonic oscillator as a function of x for n=0 and n=1. Also show graphically that the quantum probability density approaches the classical probability density for n=10.

(b) Calculate the probability of finding the particle between 0.45L and 0.55L trapped in one dimensional box of width L. **(3+2)**

5. (a) Find the tunnelling probability (T) in fusing two protons at 10^7 K (Nuclear fusion), assuming Columbic repulsion between two protons forms a square barrier of width 10 $x10^{-15}$ m.

(b) Calculate the < K.E.> in ground state of a particle confined in 1D box of width L. **(3+2)**

6. Calculate the c/a ratio and the volume of hcp unit cell. Magnesium has hcp structure. Radius of the atom is 0.1605 nm. Calculate the density. Given atomic mass of Mg=24.3 gm/mol. **(5)**

7. (a) Derive the expression for the inter-planer spacing between two parallel planes with Miller indices (h k l) and show that for the cubical lattice it is given by $\frac{a}{\sqrt{h^2+k^2+l^2}}$.

In a crystal, a lattice plane cuts intercepts of a, b/2 and 3c along crystallographic axes. Calculate miller indices of the plane and draw a neat diagram showing the plane.

(b) Atoms A and B are 0.5nm apart, atom A has ionization energy 5eV, and an atom B has an electron affinity of 4 eV. What is the energy required to transfer an electron from A to B? **(3+2)**

Constants: mass of electron = 9.1×10^{-31} kg, mass of proton = 1.67×10^{-27} kg, h = 6.63×10^{-34} Js, $K_B = 1.38\times10^{-23}$ J/K, $N_A = 6.023\times10^{23}$ atoms/mol