JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION-2022

B.Tech-II Semester (CS/IT/ECE/Civil/BT)

COURSE CODE (CREDITS): 18B11PH211 (4) MAX. MARKS: 35

COURSE NAME: ENGINEERING PHYSICS-II

COURSE INSTRUCTORS: Dr. P.B. Barman, Dr. Vineet Sharma, Dr. S.K. Tiwari, Dr. S.K. Hazra MAX. TIME: 2 Hours

Note: All questions are compulsory. Marks are indicated against each question in square brackets. Use SI system of units.

Q1. (a) Derive an expression for packing fraction of FCC and BCC. **[CO-5][2-marks]**

(b) Find the maximum radius of interstitial sphere that can just fit into the void at (½, ½, ½) between the body centred atoms of BCC structure. **[CO-5][2-marks]**

(c) Calculate the conductivity of Ge with electron and hole mobilities 0.54 and 0.18 $m^2V^{-1}s^{-1}$ respectively, assuming electron and hole densities are equal ($3.6x10^{19}$ m^{-3}). If a potential difference of 2V is applied across the Ge plate of thickness 0.2 mm and area 1 cm^2, calculate the current produced in the plate. **[CO-6][2-marks]**

Q2. (a) An SMSI fibre is made with a core diameter of 10 μm and is coupled to a laser that produces 1.8 μm light. Its core glass has a refractive index of 1.55 and the maximum cut-off number for the given fibre is 2.405. Find (i) the maximum alue required for the normalized index difference (ii) the refractive index required for the cladding glass (iii) the fibre acceptance angle. **[CO-3][2-marks]**

(b) How much will a light pulse spread after travelling along 6 km of an SI fibre, whose numerical aperture is 0.280 and core refractive index = 1.48. **[CO-3][2-marks]**

Q3. (a) Obtain the expression of (a) average velocity (b) Fermi velocity at 0K. **[CO-4][3+2-marks]**

(b) Compare MB, BE, and FD statistics. **[CO-4][3-marks]**

Q4. (a) Sketch the vector function $\vec{v} = \frac{\hat{r}}{r^2}$, and compute its divergence. Explain the result. **[CO-1][3-marks]**

(b) Height of a certain hill is given as $h(x,y) = 10(2xy-3x^2-4y^2-18x+28y+12)$, where y is the distance (in miles) north and x the distance east of Solan. **(i)** Where is the top of the hill located? **(ii)** How high is the hill? **(iii)** How steep is the slope at a point 1 mile north and one mile east of Solan? In what direction is the slope steepest at that point? **[CO-1][3-marks]**

Q5. (a) What is Poynting theorem? Derive and expression for the same. **[CO-2][3-marks]**

(b) What is the electric flux through any closed surface surrounding a charged sphere of radius a_o with volume charge density of $\rho = \rho_o\left(\frac{r}{a_o}\right)$, where r is the distance from the centre of the sphere? **[CO-1][2-marks]**

Q6. (a) Discuss the modification of Ampere's law by considering displacement current and continuity equation.

[CO-2][3-marks]

(b) Determine the electric field on both inside and outside a spherical cloud of electrons with a uniform volume charge density $\rho = -\rho_o$ for $0 \le R \le b$ and $\rho = 0$ for $R > b$. **[CO-2][3-marks]**

$\int_0^\infty x^3 e^{-ax^2} dx = \frac{1}{2a^2}$;