

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT  
TEST -3 EXAMINATION- 2023

B.Tech-II Semester (CSE/IT/ECE/CE)

COURSE CODE(CREDITS): 18B11PH211 (3)

COURSE NAME: ENGINEERING PHYSICS-II

COURSE INSTRUCTORS: PBB, SKK, VSA, SKT, HAZ, SBD

MAX. MARKS: 35

MAX. TIME: 2 Hours

Note: (a) All questions are compulsory. (b) Marks are indicated against each question in square brackets. (c) Evaluation will be done on the basis of the written component in the answer sheet.

- Q1. (a) What is physical significance of reciprocal lattice? Drive the reciprocal lattice for an fcc lattice. [CO-5] [3-marks]  
(b) The Miller indices of a plane in a simple cubic crystal are (123). Get the intercepts of the plane and sketch it. Draw the following planes in an fcc structure (112) and (120). [CO-5] [3-marks]
- Q2. (a) In a slab of specimen of width 5 mm, electrons have drift velocity of  $4 \times 10^3$  m/s under the influence of an applied electric field along the X-axis. Calculate the Hall voltage if the specimen is subjected to a magnetic field of  $4 \text{ Wb/m}^2$  along the Z -- axis. [CO-6] [3-marks]
- (b) X-rays of wavelength  $0.36 \times 10^{-8}$  cm are diffracted by a crystal in a Bragg's diffractometer at a glancing angle of  $4.8^\circ$ . Find the interplanar separation for the crystal in first order. [CO-5] [3-marks]
- Q3. (a) Derive an expression for average speed and average energy of electrons at 0 K. [CO-4] [4-marks]  
(b) At what temperature will the average speed of molecules of hydrogen gas be double the average speed of nitrogen at 300K? [CO-4] [2-marks]
- Q4. Derive an expression for intermodal dispersion and hence the bit rate per unit length. How much will be the light pulse spread after travelling along 6 km of an SI fibre , whose numerical aperture is 0.280 and core refractive index is 1.48? [CO-3] [4-marks]
- Q5. (a) A SMSI fibre with a core diameter  $10\mu\text{m}$  is coupled to a laser that produces a  $1.8 \mu\text{m}$  light. Its core glass has a refractive index 1.55 and the maximum cut-off number for the fibre is 2.405. Find (i) the maximum value required for the normalized index difference (ii) the refractive index required for the cladding glass (iii) the fibre acceptance angle [CO-3] [3-marks]  
(b) A communication system uses a 10 km fibre having a loss of 2.3 dB/km. Calculate the output power if the input power is  $900 \mu\text{W}$ . [CO-3] [4-marks]
- Q6. (a) 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,  $x$  is the distance east of Wagnaghat. Where is the top of the hill located? How high is the hill? How steep is the slope at a point 1 mile north and 1 mile east of Wagnaghat. [CO-1][3-marks]  
(b) Write corrected Maxwell's equation in terms of charge density  $\rho$  and current density  $J$ . Show that in vacuum electromagnetic wave equation is given as  $\nabla^2 B = \frac{1}{c^2} \frac{\partial^2 B}{\partial t^2}$  [CO-2][3-marks]

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$$h = 6.62 \times 10^{-27} \text{ erg sec}; 1 \text{ eV} = 1.62 \times 10^{-12} \text{ erg}; N=6.02 \times 10^{23}; m_e=9.1 \times 10^{-31} \text{ kg}; e=1.6 \times 10^{-19} \text{ C}; k=1.38 \times 10^{-23} \text{ J/K}$$