

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -3 EXAMINATIONS- 2026

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

COURSE CODE (CREDITS): **25B11PH211 (04)/18B11PH211 (04)**

MAX MARKS: 35

COURSE NAME: **Physics-2/Engineering Physics-II**

COURSE INSTRUCTOR: **PBB, SKK, SKT, SBD, HSR, HAZ**

MAX. TIME: 2 hours

Note: (a) All questions are compulsory. (b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems (c) Use of calculator is allowed

Q.No	Question	CO	Marks
Q1	(a) A virtual box of area A is divided into k compartments of unequal size, and each compartment is divided into cells of equal size, respectively. N number of distinguishable gas particles has to be distributed into each compartment such that system is in state of equilibrium. Derive the expression of number of particles in energy state E at constant temperature.	3	3
	(b) Suppose you wish to distribute three particles in two compartments. Determine their macrostate and microstate if (i) particles are distinguishable, (ii) particles are indistinguishable, (iii) particles are indistinguishable and obeys Pauli's exclusion law.	3	3
	(a) If $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$ then what is the angle between $\vec{A}$ and $\vec{B}$? (b) A plane EM wave has the magnetic field $\vec{B}(x, y, z, t) = B_0 \sin \left[(x + y) \frac{k}{\sqrt{2}} + \omega t \right] \hat{k}$ where k is the wavenumber and $\hat{i}$, $\hat{j}$ and $\hat{k}$ are the unit vectors in x , y , and z -directions respectively. What is the electric field $\vec{E}(x, y, z, t)$ corresponding to the above EM wave? (c) Eight distinguishable particles are distributed among three compartments of equal size. Find the probability of the macrostates (4,3,1), and (3,3,2).	1 4 4	1.5 2.5 2
Q3	(a) Let a and b are two energy levels in the laser system ($b > a$) immersed in the thermal radiation of a blackbody at temperature T . If B_{ab} and B_{ba} are the Einstein coefficients corresponding to absorption ($a \rightarrow b$) and stimulated emission ($b \rightarrow a$) respectively, show that in thermal equilibrium $B_{ab} = B_{ba}$.	2	3
	(b) A 3 level laser system emits the radiation of wavelength $5500 \text{ \AA}$. (i) Find the energy difference between the upper and lower level? (ii) At what temperature would the equilibrium ratio of the population of upper level to that of the lower level would be 10^{-3} ? (c) Estimate the value of $\log_e (1000!)$.	4 1	2 2
	(a) In a laser unit, laser beam of wavelength $6328 \text{ \AA}$ is emitted. How many photons are released in 2 seconds if the output power is 2 mW? (b) A substance has an FCC lattice with molecular weight 60.2 and density 6250 kg/m^3 . Calculate its lattice constant. (c) The lattice constant of a cubic lattice is ' a '. Calculate the spacing between the (1 1 2) and (2 0 0) planes.	2 4 4	2 2 2
Q5	(a) Calculate the multipath dispersion per unit length for an optical fiber with a critical angle of 60° and speed of light in core $2.5 \times 10^8 \text{ m/s}$.	2	2
	(b) Graphically present and discuss the refractive index profiles of step-index and graded-index optical fiber.	3	1
	(c) Find the atomic packing fraction of BCC unit cell.	1	2
Q6	(a) An electromagnetic wave, is travelling in an unbounded lossless dielectric medium having $\mu_r = 1$ and $\epsilon_r = 3$ and has peak electric field intensity of 6 V/m . Find (i) velocity of the wave (ii) the intrinsic impedance of the medium (iii) the peak value of H . (b) Draw $(11\bar{1})$, (121) , (111) , and $(\bar{2}10)$ planes in a unit cell. Also show their directions.	4 1	3 2

$\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$; $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$; $c = 3 \times 10^8 \text{ m/s}$; $h = 6.626 \times 10^{-34} \text{ Js}$; $k_B = 1.38 \times 10^{-23} \text{ J/K}$; $e = 1.6 \times 10^{-19} \text{ C}$; $m = 9.1 \times 10^{-31} \text{ kg}$; $N_A = 6.023 \times 10^{23}$;