JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -3 EXAMINATION- 2025
B.Tech-II Semester (CSE/IT/ECE/CE)

COURSE CODE (CREDITS): 18B11PH211 (3) MAX. MARKS: 35
COURSE NAME: Engineering Physics-II
COURSE INSTRUCTORS: PBB, SKK, VSA, SKT, HAZ, SBD, HSR 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

Q.No	Question	CO	Marks
Q1	(a) Prove that during a thermodynamic process, work done is a path function and internal energy is a state function.	3	2
	(b) Derive the adiabatic equation of state for an ideal gas in terms of temperature and pressure.	3	3
Q2	(a) How can we explain the entropy of a perfect gas in terms of pressure and volume?	3	3
	(b) You are given the following group of particles (n_i represents the number of particles with speed v_i). Compute the root mean square and most probable speeds among the entire group.	4	2

n_i	2	4	8	6	3
v_i (m/s)	1	2	3	4	5

Q3	(a) Write down the Maxwell's thermodynamic relations and give their physical significance.	4	2
	(b) A beam of electrons with kinetic energy 5 eV is incident on a region where the electron potential energy suddenly increases from 0 to 2.5 eV. Calculate the transmission and reflection coefficients at this 'step'. Sketch the electron density as a function of position.	5	3
Q4	(a) The initial temperature of a gas is 17°C. Calculate the rise in temperature when the gas is compressed suddenly to 4 times its original pressure. (Given $\gamma = 1.5$).	3	2
	(b) An electron and a proton are trapped within a spherical box of radius R. The potential within the box is defined as (V=0 for r<R, and V=R/0, r≥R). In equilibrium, the minimum distance between electron and proton is r. (i) Write the appropriate Schrödinger equation for this system. (ii) Suggest a solution of Schrodinger equation and draw the graph of wave functions in ground state.	5	3
Q5	(a) Two Carnot engines A and B are operating in series. The first one A receives heat at 1000 K and rejects to a reservoir at temperature T K. The second engine B receives the heat rejected by A and in turn rejects to a heat reservoir at 300 K. Calculate the temperature T for the situations when (i) The work outputs of two engines are equal (ii) The efficiency of two engines are equal.	2	3
	(b) The kinetic energy of an electron is 4.55×10^{25} J, then calculate the velocity, momentum, and wavelength of electron.	2	2
Q6	(a) What is latent heat equation and write down its applications.	3	3
	(b) A system has 5 different macrostates, under which there are 6, 20, 42, 12 and 2 microstates. A property x associated with the system has values 4, 4, 2, 6 and 10 respectively, for the 5 macrostates. Calculate (i) probabilities for the different macrostates and (ii) average values of x and of $\sqrt{x^2}$.	4	2
Q7	(a) Derive Planck's law for blackbody radiation. Also show that the total energy density of radiation is proportional to the 4th power of temperature in Kelvin.	4	3
	(b) Obtain the expression for the average speed and average energy of electrons at zero Kelvin temperature.	4	2

m_e=9.1x10^{-31} kg; h=6.626x10^{-34} Js; c=3x10^8 m/s; k=1.38x10^{-23} J/K; $\int_0^\infty \frac{x^3 dx}{e^x - 1} = \frac{\pi^4}{15}$;