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JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY
 End Term Examination, May 2026
 B. Tech. (Section A, B and C), Semester II

Roll No.....

AS1108: Applied Physics

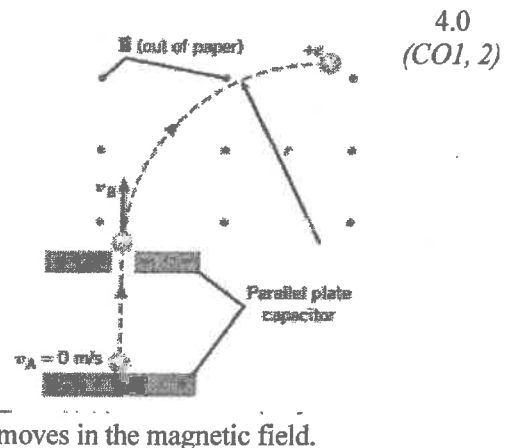
Time: 2 hours

Max. Marks: 30

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Mention all the assumptions for your answers clearly.
3. Scientific calculators are allowed.

- Q. 1 A proton is released from rest at point A, which is located next to the positive plate of a parallel plate capacitor shown in right side figure. The proton then accelerates toward the negative plate, leaving the capacitor at point B through a small hole in the plate. The electric potential of the positive plate is 2500 V greater than that of the negative plate. Once outside the capacitor, the proton travels at a constant velocity until it enters a region of constant magnetic field of magnitude 0.20 T. Find



- a. the speed v_B of the proton when it leaves the negative plate of the capacitor.
- b. the radius r of the circular path on which the proton moves in the magnetic field.

- Q. 2 A small rubber wheel on the shaft of a mild hybrid car generator presses against the car tire and turns the coil of the generator at an angular speed that is 80 times as great as the angular speed of the tire itself. Each tire has a radius of 0.2 m. The coil consists of 200 turns, has an area of $5.0 \times 10^{-3} \text{ m}^2$, and rotates in a 0.04-T magnetic field. The car starts from rest and has an acceleration of 0.2 m/s². What is the peak emf produced by the generator at the end of 5 seconds?
- 4.0
(CO2, 3)

- Q. 3 Suppose that the light bulb as in given Figure is a 60.0-W bulb with a resistance of 100 Ω . The magnetic field has a magnitude of 0.40 T, and the length of the rod is 0.60 m. The only resistance in the circuit is that due to the bulb. What is the shortest distance along the rails that the rod would have to slide for the bulb to remain lit for one half second?
- 2.0
(CO2, 3)

- Q. 4 A point is given as ($\rho = 5$, $\phi = 45^\circ$, $z = 5$). Convert it into Cartesian and then spherical coordinates. Find the volume of a sphere using spherical coordinates
- 5.0
(CO1)

- Q.5 A drone flies at 30 m/s at height 120 m dropping water on fire.
- 5.0
(CO1, 2)
- (a). At what distance should water be released?
 - (b). What is its impact velocity

- Q.6 A 1.00 g marble is constrained to roll inside a tube of length $L = 1.00 \text{ cm}$. The tube is capped at both ends.
- 4.0
(CO4, 5)

- (a). Modeling this as a one-dimensional infinite square well, determine the value of the quantum number n if the marble is initially given an energy of 1.00 mJ.
- (b). Calculate the excitation energy required to promote the marble to the next available energy state. i.e Energy require to go from E_n to E_{n+1} state.

Q.7 (a). An electron has the same de Broglie wavelength as the wavelength of a 1.8 eV photon.

4.0
(CO5)

What is the speed of the electron?

- (b). A molecule of roughly spherical shape has a mass of 6.10×10^{-25} kg and a diameter of 0.70 nm. The uncertainty in the measured position of the molecule is equal to the molecular diameter. What is the kinetic energy of the molecule if its speed is equal to the minimum uncertainty possible in its speed?

Q.8 The wave function for an electron that is confined to $x \geq 0$ nm is

2.0
(CO4)

$$\psi(x) = \begin{cases} 0, & \text{for } x < 0 \text{ nm} \\ Ae^{-x/(2.3 \text{ nm})}, & \text{for } x \geq 0 \text{ nm} \end{cases}$$

What is the probability of finding the electron in the interval $1.15 \text{ nm} \leq x \leq 1.84 \text{ nm}$?

All the best!