Name: **Enrolment No:**	

UPES

End Semester Examination, May 2023

Course: Electromagnetic fields theory **Semester: IV**

Program: B. Tech Electrical **Time: 03 hrs.**

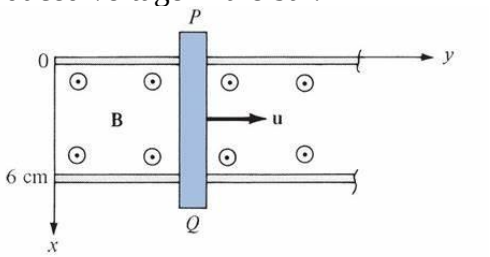
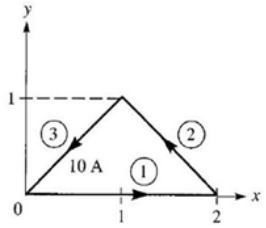
Course Code: ECEG 2007 **Max. Marks: 100**

SECTION A

S. No.		Marks	CO
Q 1	Derive the Poisson's equation using Gauss's law.	**04**	**CO2**
Q 2	Find the gradient and Laplacian in the scalar field quantity: W = 10r $\sin^2\theta\cos\emptyset$.	**04**	**CO1**
Q 3	A parallel plate capacitor with a plate area of 5 cm^2 and plate separation of 3 mm has a voltage 50 $\sin 10^3$t V applied to its plates. Calculate the displacement current by assuming $\in = 2 \in_0$.	**04**	**CO2**
Q 4	Derive the expression for skin depth of a conducting medium.	**04**	**CO3**
Q 5	Two-point charges -4μC and 5 μC are located at (2, -1, 3) and (0,4, -2) resp. Find the potential at (1,0,1) assuming zero potential at infinity.	**04**	**CO2**

SECTION B

Q 6	Given that D = $z\rho cos^2\emptyset\ a_z\ C/m^2$, calculate the charge density at (1,$\frac{\pi}{4}$,3) and the total charge enclosed by the cylinder of radius 1 m with -2 ≤ z ≥ 2 m.	**10**	**CO1**
Q 7	Analyze the behavior of two medium and then develop the boundary conditions for the electric field at a boundary between the conductor-dielectric materials.	**10**	**CO5**

Q 8	A conducting bar can slide freely over two conducting rails as shown in the figure below. Calculate the induced voltage in the bar:  (i) If the bar is stationed at y=8 cm and B=4cos 10^6t a_z mWb/m^2 (ii) If the bar slides at a velocity u=20a_y m/s and B=4a_z mWb/m^2 (iii) If the bar slides at a velocity u=20a_y m/s and B= 4 cos(10^6-y)a_z mWb/m^2 OR Determine "H" at (0,0,4) due to side 3 of the given triangular loop. The conducting triangular loop carries a current of 10 A.  	**10**	**CO3**
Q 9	State Ampere's Circuit law and derive the expression for infinity long coaxial transmission line using Ampere's Circuit law.	**3+7**	**CO1**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	A metal bar of conductivity σ is bent to form a flat 90° sector of inner radius a, outer radius b and thickness t. Show that: (i) The resistance of the bar between the vertical curved surfaces at $\rho = a$ and $\rho = b$ is $R = \frac{2\ln\frac{b}{a}}{\sigma\pi t}$ (ii) The resistance between the two horizontal surfaces at z=0 and z=t is R'=$\frac{4t}{\sigma\pi(b^2-a^2)}$ OR a) Explain the term lossy dielectric and deduce the expression for the wave propagating in lossy dielectrics. b) A lossy dielectric has an intrinsic impedance of 200$\angle$ 30° at a particular radian frequency ω. If, at that frequency, the plane wave propagating through the dielectric has the magnetic field component:	**20**	**CO4**

	H=$10e^{-\alpha x}\cos(\ \omega t - 0.5x)\ a_y\ A/m$. Find E and α.		
Q 11	Two extensive homogeneous isotropic dielectrics meet on plane z=0. For z>0, $\in_{r1}$=4 and for z<0, $\in_{r2}$=3. A uniform electric field $E_1 = 5a_x - 2a_y + 3a_z$ kV/m exists for z ≥ 0. Find: i) $E_2\ for\ z \leq 0$. ii) The angle $E_1\ and\ E_2\ make$ with the interface. iii) The energy densities (in J/m^3) in both dielectrics. The energy within a cube of side 2 m centered at (3, 4, -5)	**20**	**CO5**