


Name:			
Enrolment No:			
UPES End Semester Examination, December 2024			
Course: Introduction to Electricity & Magnetism Program: B.Sc BSc-Geo & Math Course Code: PHYS2032		Semester: III Time: 03 hrs. Max. Marks: 100	
Instructions: All questions are compulsory.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	State and prove Ampere's circuital law.	5	CO3
Q 2	State and explain Faraday's laws of electromagnetic induction.	5	CO2
Q 3	Distinguish diamagnetic, paramagnetic and ferromagnetic materials.	5	CO4
Q 4	Write the Maxwell's equations in integral form.	5	CO4
Q 5	The scalar field in a region is represented by $U = x^2y + xyz$. Find the gradient of the scalar field.	5	CO1
SECTION B (4Qx10M= 40 Marks) Question no. 8 has an internal choice.			
Q 6	What is a solenoid? Obtain an expression for the field on the axis of a solenoid.	10	CO3
Q 7	Derive the equation of continuity and discuss its physical significance.	10	CO4
Q 8	A coil consisting of 100 circular loops with a radius of 0.60 m carries a 5.0 A current. Along the axis, at what distance from the center of the coil is the magnetic field $\frac{1}{8}$ as great as it is at the center. OR Using Gauss's law of electrostatics, determine the electric field at a point due to an infinite plane sheet of charge.	10	CO2
Q 9	(a) Find the constant "a" for which vector $\vec{A} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + az)\hat{k}$ is solenoidal. (b) For a vector field A, show that $\nabla \cdot \nabla \times \vec{A} = 0$; that is, the divergence of the curl of any vector field is zero.	10	CO1
SECTION-C (2Qx20M=40 Marks) Question no. 10 has an internal choice.			
Q 10	(a) Define the capacitance of a capacitor. Calculate the capacitance of a parallel plate capacitor.	10	CO3

	<p>(b) Two parallel plates of a capacitor having equal and opposite charges are separated by 6.00 mm thick dielectric material of dielectric constant 2.8. If the electric field strength inside is 10^5 V/m. Determine the polarization vector, displacement vector, and energy density in the dielectric.</p> <p style="text-align: center;">OR</p> <p>State the Gauss's law of electrostatics. If the electric charge Q is distributed uniformly along an infinitely long, thin wire. The charge per unit length is λ (assumed positive). Find the electric field at a distance r from the wire field using Gauss's law.</p>	10	
		20	
Q 11	<p>(a) Deduce the equation for the propagation of plane electromagnetic waves in free space. Show that electric and magnetic field vectors are normal to each other.</p> <p>(b) The relative magnitude of \vec{H} in a plane wave is 1 amp./meter. Determine the magnitude of \vec{E} for a plane wave in free space.</p>	15	CO4
		5	