M.Sc.(Physics) (CBCS Pattern) First Semester **PSCPHYT04 - Paper-IV (Core-4) : Electrodynamics-I**

P. Pages : 2 Time : Three Hours		2 ree Hours $x = 3 = 2 = 8 = 5 + 3 = 2 = 8 = 5 + 3 = 2 = 8 = 5 + 3 = 3 = 3 = 3 = 3 = 3 = 3 = 3 = 3 = 3$
1.		EITHER
	a)	Define electric field and obtain its expression for discrete, line, surface and volume charge distributions.
	b)	Find the electric field at distance 'Z' above the midpoint of a straight line segment of length 2L that carries a uniform line charge λ . Show that in the limit $L \rightarrow \infty$, $E = \frac{1}{4\pi\epsilon_0} \frac{2\lambda}{Z}$.
	c)	An infinite plane carries a uniform surface charge σ . Find its electric field. 3
		OR
	e)	State and prove Gauss's law. Derive an expression for electric field due to a solid sphere 10 of radius R at a point out side and inside the solid sphere.
	f)	Derive Poisson and Laplace's equations.
2.		EITHER
	a)	What are uniqueness theorems? How are they useful in electrostatics? State and prove first uniqueness theorem.
	b)	Using method of images, show that induced charge on an infinite grounded plane, with a point charge 'q' placed at a distance 'd' above it, is equal to '-q'.
		OR
	e)	Obtain a solution for potential described by Laplace equation in three dimensional cartesian coordinates.
	f)	Derive an expression for multipole expansion of potential. Explain monopole and dipole terms.
3.		EITHER
	a)	State and prove Biot-Savart law. 4
	b)	Explain magnetic shielding. 4
	c)	Derive an expression for Ampere's law in differential form and obtain its integral version.
		OR

	e)	Derive an expression for the vector potential of a localized current distribution.	8
	f)	Show that magnetic field inside a cavity of spherical shell, kept in curiform field is inversely proportional to ' μ '.	8
4.		EITHER	
	a)	Derive an expression for Faradays law in differential form.	5
	b)	What is displacement current? How is it useful to obtain Ampere's law.	5
	c)	State Maxwell's equations in integral and differential form give their physical significance.	6
		OR	
	e)	State and derive Poynting's theorem.	8
	f)	Show that the wave equation can be written in the form $\left(\overrightarrow{\nabla}^2 + \overrightarrow{K}^2\right) \overrightarrow{E} = 0.$	8
5.		Answer all the followings :	
		a) State and explain Coulomb's law in vector form.	4
		b) Explain Green's Theorem.	4
		c) Deduce 'Ampere's law ' from Biot-Savart law.	4
		d) How did Maxwell modified Ampere's law? And Why?	4
