ELECTROMAGNETIC THEORY

Time: 3 hrs **Max. Marks: 100**

Answer ALL questions

PART A (10 x 2=20)

1 Find the dot product of the vectors if $\vec{A} = 2\vec{a}_x - 3\vec{a}_y$ and $\vec{B} = -\vec{a}_x + 2\vec{a}_z$.

2 Define Electric Field Intensity.

3 Name any four applications of Gauss's Law in electrostatics.

4 Under what condition will the electric field (E) be solenoidal?

5 Define current density.

6 Derive the Poisson's equation.

7 What is the relation between magnetic field intensity and magnetic flux density?

8 State Ampere's circuital law.

9 Write the point form of Maxwell's equation for static fields

10 Define pointing vector? What is the SI unit for this vector.

PART - B (5x16 = 80)

11 a) (i) Derive an expression for electric field intensity $\vec{E}$ due to an uniformly charged infinitely long straight line with constant charge density in C/m (8)

(ii) Explain about Cylindrical Coordinate system (4)

(iii) Find the angle between the vectors A=$2\overrightarrow{a_x}$+$4\overrightarrow{a_y}$-$\overrightarrow{a_z}$ and B=$3\overrightarrow{a_x}$+$6\overrightarrow{a_y}$-$4\overrightarrow{a_z}$ using Dot Product. (4)

(OR)

b) (i) Four point charges each of 10μC are placed in free space at the points (1, 0, 0), (-1, 0, 0), (0, 1, 0) and (0,-1, 0) m respectively. Determine the force on a point charge of 30μC located at a point (0,0,1) m. (4)

(ii) State and explain coulomb's law. (8)

(iii) Write short notes on Dot product and Cross product. (4)

12 a) (i) State and prove Divergence Theorem. (8)

(ii) Given A=2xy$\overrightarrow{a_x}$+Z$\overrightarrow{a_y}$+yz^2$\overrightarrow{a_z}$.Find ∇. A at P (2,-1, 3). (4)

(iii) Derive Electric flux density due to a point charge and establish relationship between electric flux density and electric field intensity. (4)

(OR)

b) (i) State and prove Gauss's Law with the help of a spherical system (8)

(ii) A dipole having moment $P = 3\overrightarrow{a_x} - 5\overrightarrow{a_y} + 10\overrightarrow{a_z}$ nCm is located at Q (1,-2, 4) in free space. Find V at P (2, 3, 4). (4)

(iii) Derive the potential due to a point charge at the origin. (4)

13 a)	(i)	State and derive electric boundary conditions for a dielectric to dielectric medium and a conductor to dielectric medium.	(8)
	(ii)	Derive the expression for energy stored in a capacitor.	(4)
	(iii)	Verify that the potential field given below satisfies the Laplace's equation $V= 3x^2-3y^2+z^2$	(4)
		(OR)	
b)	(i)	Derive an expression for the capacitance of a parallel plate capacitor with two dielectrics of relative permittivity ε_1 and ε_2 respectively interposed between the plates.	(8)
	(ii)	Calculate the capacitance per kilo meter between a pair of parallel wires each having diameter of 1 cm at a spacing of 50 cm.	(4)
	(iii)	State and prove uniqueness theorem.	(4)
14 a)	(i)	Derive an expression for inductance of a Co-axial cable.	(8)
	(ii)	Derive an expression for magnetic flux density and magnetic field intensity due to an infinitely long conductor.	(4)
	(iii)	A coil of 500 turns is wound on a closed iron ring of mean radius of 10 cm and cross-section area of 3 cm^2. Find the self inductance of the winding if the relative permeability of iron is 800.	(4)
		(OR)	
b)	(i)	State and prove stokes theorem.	(5)
	(ii)	Explain Biot-Savart's Law.	(5)
	(iii)	Derive an expression for magnetic field intensity at any point on the infinite sheet of current carrying conductor.	(6)
15 a)	(i)	Derive the average power using Poynting theorem.	(6)
	(ii)	Write short notes on EMI and EMC.	(4)
	(iii)	Explain the electromagnetic wave propagation in perfect dielectric.	(6)
		(OR)	
b)	(i)	Derive the wave equation for magnetic field and electric field in phasor form.	(8)
	(ii)	Compare between electric circuits and magnetic circuits.	(4)
	(iii)	Briefly explain about skin effect.	(4)

Staff In charge

Head of the Department