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BTECH
(SEM III) THEORY EXAMINATION 2023-24
ELECTROMAGNETIC FIELD THEORY

TIME: 3HRS

M.MARKS: 100

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

Q no.	Question	Marks	CO
a.	Describe gradient of a scalar field.	2	CO1
b.	State the Gauss's divergence theorem.	2	CO1
c.	Define Electric dipole moment.	2	CO2
d.	Establish the relation between electric potential and electric field intensity.	2	CO2
e.	Write the Maxwell's equations for time varying condition.	2	CO3
f.	What is the inconsistency in Ampere's circuital law?	2	CO3
g.	Explain the term magnetic flux density and magnetic permeability.	2	CO4
h.	Explain the term Inductance.	2	CO4
i.	Explain the application of transmission lines.	2	CO5
j.	Explain the physical significance of Poynting vector.	2	CO5

SECTION B

2. Attempt any three of the following:

a.	State and explain the divergence theorem in detail.	10	CO1
b.	Explain Gauss's Law- Maxwell's equation.	10	CO2
c.	Explain conduction and convection currents. Derive mathematical equations also. Derive the magnetic vector potential.	10	CO3
d.	A small current loop L_1 with magnetic moment $5\mathbf{a}_z$ A.m ² is located at the origin while another small loop current L_2 with magnetic moment $3\mathbf{a}_y$ A.m ² is located at (4,-3,10). Determine the torque on L_2 .	10	CO4
e.	Define the terms and obtain expression for the voltage wave standing ratio, reflection coefficient and reflection percentage on a loss free transmission line having mismatch.	10	CO5

SECTION C

3. Attempt any one part of the following:

a.	Explain the differential length, differential area, differential volume in Cartesian and cylindrical Coordinates.	10	CO1
b.	State and prove Stokes's theorem in detail.	10	CO1

4. Attempt any one part of the following:

a.	What is the coulomb's law of field intensity? Write the Limitations of Coulomb's Law. What will be the electrostatic force between the two-point charges of charges $+2\mu\text{C}$ and $+4\mu\text{C}$ repel each other with a force of 20N when a charge of $-6\mu\text{C}$ is added to each of them?	10	CO2
b.	Define the continuity equation and discuss the relaxation time in dielectric and conducting materials.	10	CO2

5. Attempt any one part of the following:

a.	Explain the complete magnetic boundary conditions in detail. Derive all the tangential and normal components.	10	CO3
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b.	By using Biot-Savart's law determine magnetic flux intensity (H) at (0,0,4) and (0,0,-4) for a circular loop located on $x^2 + y^2 = 9, z = 0$ carries a direct current of 10A along \mathbf{a}_ϕ .	10	CO3
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6. Attempt any *one* part of the following:

a.	Derive the expression for energy stored in magnetic field.	10	CO4
b.	Determine the self-inductance of a coaxial cable of inner radius a and outer radius b .	10	CO4

7. Attempt any *one* part of the following:

a.	Derive the wave propagation equation in dielectric medium. Find out the propagation constant, attenuation constant and phase shift constant also.	10	CO5
b.	What is transmission line? Discuss various types of transmission lines.	10	CO5

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