



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

TIME: 3HRS

M.MARKS: 70

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

SECTION A

1. Attempt all questions in brief.

2 x 7 = 14

Q no.	Question	Marks
a.	Give the physical significance of divergence.	2
b.	Compute $\nabla \times \nabla V$ if $V = xyz$	2
c.	Write the Maxwell's equation for static field in point form.	2
d.	Give the physical significance of $\nabla \cdot \mathbf{B} = 0$	2
e.	Explain the concept of magnetic flux density .	2
f.	Differentiate self-inductance and mutual inductance.	2
g.	State the Faraday's law.	2

SECTION B

2. Attempt any three of the following:

7 x 3 = 21

a.	Find the Laplacian if $V = \rho^2 z \cos 2\theta$	7
b.	Establish the equations for boundary condition for both \mathbf{D} and \mathbf{E} .	7
c.	Explain the Ampere's circuital law and derive their applications.	7
d.	What is magnetic energy? Derive the mathematical expression for Magneto-static energy density.	7
e.	Derive uniform plane wave for lossy dielectric medium.	7

SECTION C

3. Attempt any one part of the following:

7 x 1 = 7

a.	Given that a vector function $\vec{A} = (3x + c_1z)\hat{a}_x + (c_2x - 5z)\hat{a}_y + (4x - c_3y + c_4z)\hat{a}_z$. Examine the values c_1, c_2, c_3 and c_4 if A is irrotational and solenoidal.	7
b.	Organize vector $\vec{A} = r \sin \theta \hat{a}_r$, into Cartesian coordinate system considering \vec{A} is in spherical coordinate system.	7

4. Attempt any one part of the following:

7 x 1 = 7

a.	For the given vector $\vec{D} = x^2y \hat{a}_x + z \hat{a}_z$; Examine the volume charge density at (1, 1, 1) and electrostatic energy for the region $-1 < x < 1; -1 < y < 1; -1 < z < 1$	7
b.	Compute $\text{div}(\text{grad}V)$ in all co-ordinate system.	7

5. Attempt any one part of the following:

7 x 1 = 7

a.	Explain the Biot Savartz law. Find the H for infinite, finite and semi-infinite length conductors.	7
b.	Derive the Maxwell's equations associated to curling fields for static field in integral form.	7

6. Attempt any one part of the following:

7 x 1 = 7

a.	Establish the equations for boundary condition for both \mathbf{B} and \mathbf{H} . Also discuss modified ampere's circuital law.	7
b.	Explain the concept of magnetic scalar and vector potential. Prove that $\mathbf{B} = \nabla \times \mathbf{A}$.	7

7. Attempt any one part of the following:

7 x 1 = 7

a.	Establish the relations for propagation constant, attenuation constant, phase constant and phase velocity for lossless and distortionless transmission line.	7
b.	Derive the telegraphic equations for transmission line.	7