



**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 <b>magnetic flux density</b> .	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 $V = \rho^2 z \cos 2\phi$	7
b.	Establish the equations for boundary condition for both <b>D</b> and <b>E</b> .	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 <b>lossy dielectric</b> 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 <b>div(gradV)</b> 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 <b>B</b> and <b>H</b> . Also discuss modified ampere's circuital law.	7
b.	Explain the concept of magnetic scalar and vector potential. Prove that <b>B = ∇ × A</b> .	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