PAPER ID-311630

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM III) THEORY EXAMINATION 2024-25
ELECTROMAGNETIC FIELD THEORY

TIME: 3 HRS **M.MARKS: 100**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q no.	Question	CO	Level
a.	Convert the point (2,6,3) into a spherical coordinate system.	CO1	K_2
b.	Compute the gradient of the scalar field $f(x,y,z) = x^2 + y + z$ at point (2,0,1).	CO1	K_2
c.	List the type of charge distribution with examples.	CO2	K_2
d.	Describe how $\vec{E} = -\nabla V$, where E and V denote electric field and electric potential respectively.	CO2	K_2
e.	Define Lorentz's law of force.	CO3	K_1
f.	State that the $\oint B.\, ds$ is zero in a static magnetic field	CO3	K_1
g.	Describe magnetic moment.	CO4	K_2
h.	State ampere's circuital law in a static magnetic field.	CO4	K_1
i.	Explain the physical significance of the Poynting vector.	CO5	K_2
j.	A conductor of 1m length is moved with a velocity of 100 m/sec perpendicular to a field of 1 Tesla. Compute the value of e.m.f induced.	CO5	K_2

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

Q no.	Question	CO	Level
a.	Given vector field $\vec{G} = 8sin\varphi a_r$ is in spherical coordinate, modify it into the cylindrical and rectangular coordinate system.	CO1	K_3
b.	Determine the electric field in space due to charged finite length wire having uniform charge density.	CO2	K_3
c.	Explain Biot-Savart's law for magnetic fields. How can this concept be used to determine the magnetic field in space due to a closed-loop current-carrying wire?	CO3	K_4
d.	Verify that magnetostatic energy is given by $W_n = \frac{1}{2}\int \mu H^2 dv$	CO4	K_5
e.	Determine the solution of the plain wave equation in a conducting medium. (lossy dielectric)	CO5	K_3

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

Q no.	Question	CO	Level
a.	Derivethe Gauss divergence theorem.	CO1	K_3
b.	Examine the gradient of any scaler V and divergence and curl of any vector$\overrightarrow{A}$ in different co-ordinate systems	CO1	K_3

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4. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	A potential field in free space is expressed as, $V = \frac{60sin\theta}{r^2}$ volt. Determine the electric flux density and hence the volume charge density at the point (r=3m, $\theta = 60^0, \emptyset = 25^0$) in spherical coordinates.	CO2	K_3
b.	Explain the concept of energy stored and energy density in static electric field.	CO2	K_4

5. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Derive the expression of magnetic field for an infinitely long coaxial transmission.	CO3	K_3
b.	Determine the magnetic flux density B at a distance of d meter from an infinite straight wire carrying current I. Also, the flux density when the wire is semi-infinite.	CO3	K_3

6. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Explain the concept of magnetization and susceptibility.	CO4	K_4
b.	Derive an expression for the inductance of solenoid and toroid.	CO4	K_3

7. Attempt any *one* part of the following: 10 x 1 = 10

Q no.	Question	CO	Level
a.	Derive and state the Poynting theorem for EM wave.	CO5	K_3
b.	Derive an expression of characteristic impedance and propagation constant for a general and lossless transmission line.	CO5	K_3