B. TECH
(SEM III) THEORY EXAMINATION 2022-23
ELECTROMAGNETIC FIELD THEORY

Time: 3 Hours   *Total Marks: 100*

Notes:
- *Attempt all Sections and Assume any missing data.*
- *Appropriate marks are allotted to each question, answer accordingly.*

SECTION A

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

   (a) What is Conductance?
   (b) Define the term Magnetization and magnetic dipole moment.
   (c) State the Gauss divergence theorem.
   (d) Find the distance between the pair of points;
        $(4, \pi/3, 5)$ and $(-1, \pi/2, 3)$
   (e) Explain Electric Flux density.
   (f) A charged particle moves with a uniform velocity $4\hat{a}_x$ m/sec in a region where $\vec{E} = 20\hat{a}_y$ V/m and $\vec{B} = B_o\, \hat{a}_z$ Wb/m^2. Find the value of B_o such that the net force on the particle is zero.
   (g) Prove that the $\oint_s \vec{B}.\vec{ds}$ is zero in static magnetic field.
   (h) Write the Maxwell's equations for time varying condition.
   (i) Derive a relation between current density $\vec{J}$ and magnetic field $\vec{H}$.
   (j) Explain Poynting vector.

SECTION B

2.   **Attempt any *three* of the following:**   **10x3=30**

   (a) An airplane has a ground speed of 200 km/hr in the direction due west. If there is a wind blowing northwest at 50 km/hr. Find the true air speed and heading of the airplane.
   (b) Discuss about the displacement current and derive the expression of displacement current density.
   (c) Find the expression of magnetic field intensity for an infinite line current.
   (d) Derive and explain the boundary condition for static magnetic field.
   (e) Derive an expression of electric field intensity at all the possible location for a uniforml charged sphere.

SECTION C

3.   **Attempt any *one* part of the following:**   **10x1=10**

   (a) State and prove Stoke's theorem.
   (b) Write the expression of gradient, divergence and curl for the mostly used three orthogonal coordinate systems.

4.   **Attempt any *one* part of the following:**   **10x1=10**

   (a) State Gauss Law and what are the necessary conditions for applying it.
   (b) What is Electric potential? Derive the expression of potential difference between two points.

5.   **Attempt any *one* part of the following:**   **10x1=10**
   (a) State and prove the Maxwell's equations for static magnetic field.
   (b) Derive the expression of magnetic field for an infinitely long coaxial transmission

line.

6. **Attempt any _one_ part of the following:** 10x1=10
(a) Discuss magnetic torque and differentiate with magnetic dipole moment.
(b) What is magnetic energy? Derive the mathematical expression.

7. **Attempt any _one_ part of the following:** 10x1=10
(a) What is Smith chart? Discuss its importance and application in transmission line.
(b) Derive the equation of characteristic impedance, and propagation constant for a general line and lossless line.