R20

II B. Tech I Semester Supplementary Examinations, July - 2023
ELECTRO MAGNETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 hours   Max. Marks: 70

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) State and explain Coulomb's law of electrostatic field in vector form.   [7M]
   b) Derive expression for electric field due to infinite uniformly charged sheet.   [7M]

Or

2 a) Derive Poisson's and Laplace's equation.   [7M]
   b) A point charge of 10 nC is placed at the origin. While another point charge of   [7M]
       8 nC is placed at (2,3,4). Find the potential at point (-1,2,-3).

UNIT-II

3 a) What is dipole? Derive the expressions for potential and electric field intensity   [7M]
       due to a dipole.
   b) Compute the torque for a dipole comprising 1 µC charge in an electric field   [7M]
       $\mathbf{E} = 10^3$ (z $\mathbf{a_x}$-$\mathbf{a_y}$-$\mathbf{a_z}$) V/m separated by 1mm and located on the z-axis at the
       origin.

Or

4 a) Obtain the expression for energy density in a static electric field.   [7M]
   b) Two parallel conducting plates 3cm apart and situated in air are connected to a   [7M]
       source of voltage is 72 kV. Determine the electric field intensity between the
       plates. Is its within permissible value? If a mica sheet ($\varepsilon_r = 4$) of thickness 1 cm
       is introduced between the plates, determine the field intensity in air and mica,
       given the dielectric strength of air and mica as 30 and 1000 kV/cm respectively.
       Comment on the results.

UNIT-III

5 a) Derive an expressions for magnetic field intensity at any point on the axis of   [7M]
       circular coil carrying current.
   b) A straight conductor in air carries a current of 5A. Calculate the flux density   [7M]
       produced by 10 cm length of the conductor at a point 1 m distance along the
       perpendicular bisector drawn to the conductor length.

Or

6 a) State and discuss Amperes circuital law.   [7M]
   b) Derive an expression for the force on a current element in a magnetic field.   [7M]

UNIT-IV

7 a) Derive the expression for mutual inductance between two coils.   [7M]
   b) A solenoid 5 cm in length consists of 200 turns and has a cross sectional radius   [7M]
       of 1 cm. Find the inductance of solenoid. What is the value of current required to
       maintain a flux of 2 mWb in the toroid? Take $\mu_r = 800$.

Or

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8   a)   Derive the expression for energy density in a magnetic field.   [7M]

    b)   A 6000 turns solenoid is 3 m long and has a diameter 10 cm, calculate the inductance of the solenoid and energy stored when a current of 12 A is flowing through the coil.   [7M]

UNIT-V

9   a)   State Maxwell's equations and obtain them in integral form.   [7M]

    b)   Explain induced emf and derive the expressions for statically and dynamically induced emfs.   [7M]

Or

10   a)   Explain the concept of displacement current and obtain an expression for the displacement current density.   [7M]

    b)   A square coil of side 60cm is situated in a uniform magnetic field with its axis normal to the field. If the coil is rotated at 1500 rpm about its central axis, find the maximum value of the induced emf. Consider $B = 0.8$ Wb/ m^2.   [7M]

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