<b>Total</b>	No.	$\mathbf{of}$	Questions	:	10]
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SEAT No.:	
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[Total No. of Pages : 2

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## [4959]-1069

## **B.E.**(Electrical)

## **ELECTROMAGNETIC FIELDS**

(2012 Pattern) (Elective-II)(403144)(End Sem.)(Semester-I)

Time :2½ Hours] [Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q1 or Q2, Q3 or Q4,Q5 or Q6, Q7or Q8,Q9 or Q10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of logarithmic tables, slide rules, Mollier Charts, electroinic pocket calculator and steam tables is allowed.
- 5) Assume suitable data, if necessary.
- Q1) a) Using Gauss's law obtain the expression for  $\bar{E}$  and  $\bar{D}$  due to infinite surface charge with uniform surface charge density  $\rho_s$  C/m<sup>2</sup> [6]
  - b) If  $\overline{J} = \frac{1}{r^3} \left( 2\cos\theta \widehat{a}_r + \sin\theta \widehat{a}_\theta \right) A/m^2$ , calculate the current passing through a hemispherical shell of radius 20 cm. [4]

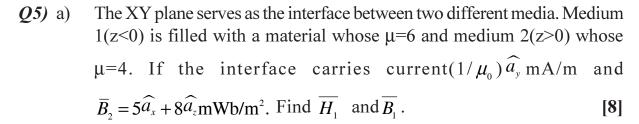
OR

- **Q2)** a) Derive the expression for the energy stored per unit volume in an electric field in terms of  $\bar{D}$  and  $\bar{E}$ .
  - b) Explain the physical significance of curl. [4]
- Q3) a) Obtain the  $\overline{H}$  (magnetic field intensity) due to infinitely long straight conductor carrying current I at any point P using Ampere's circuital law. [6]
  - b) State the integral and point form of Gauss's law. [4]

OR

- **Q4)** a) Using Laplace equation, derive the expression for the capacitance of coaxial cable, which is located along z-axis with inner conductor of radius 'a' and outer conductor of radius 'b'. Assume  $V=V_0$  at r=a & V=0 at r=b.
  - b) A circular loop located on  $x^2 + y^2 = 9$ , z = 0 carries a direct current of  $10 \, \text{A}$  along  $\widehat{a}_{\phi}$ . Determine  $\overline{H}$  at (0,0,4).

P.T.O.



b) Derive an expression for the torque T in a filamentary closed circuit carrying direct current. Explain why the total force is zero in a closed circuit carrying direct current. [8]

- Explain the behavior of diamagnetic, paramagnetic and ferromagnetic *Q6*) a) materials in magnetic field with examples of each. [8]
  - Given a material for which  $\chi_m = 3.1$  and within which  $\bar{B} = 0.4y \hat{a}_z$  T, b) find:
    - i)  $\bar{H}$

- n) μ v) J
- iii) µ

iv) M

- vi) J<sub>b</sub>
- Using Faraday's law, explain with help of diagram the concept of **Q7**) a) transformer emf and motional emf. [8]
  - In free space  $\overline{E}$  =20cos( $\omega$ t-50x)  $\widehat{a}_y$  V/m.Calculate  $\overline{J}_d$ ,  $\overline{H}$ . b) [8]

- State the Maxwell's equation in integral form for static fields. Derive an *Q8*) a) equation for displacement current density. [8]
  - State the point form and integral form of Maxwell's equation for time b) varying fields. [8]
- What is Poynting vector? What is its significance? Derive the expression **Q9**) a) of Poynting vector? [10]
  - Derive the wave equations for a lossy dielectric medium. b) [8]

OR

- What is uniform plane wave? State and explain Maxwell's equation in *Q10)*a) phasor form for time harmonic electromagnetic fields in a linear, isotropic and homogenous medium. [10]
  - Write the properties of plane waves in good conductors. Explain the b) concept of skin effect. [8]



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