

Total No. of Questions : 10]

SEAT No. :

P3525

[4959]-1069

[Total No. of Pages : 2

B.E.(Electrical)

ELECTROMAGNETIC FIELDS

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

Time : 2½Hours]

[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 ρ_s C/m² [6]

b) If $\bar{J} = \frac{1}{r^3} (2 \cos \theta \hat{a}_r + \sin \theta \hat{a}_\theta) A/m^2$, 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} . [6]

b) Explain the physical significance of curl. [4]

Q3) a) Obtain the \bar{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 co-axial 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 $r = b$. [6]

b) A circular loop located on $x^2 + y^2 = 9, z = 0$ carries a direct current of 10 A along \hat{a}_ϕ . Determine \bar{H} at (0,0,4). [4]

P.T.O.

Q5) a) The XY plane serves as the interface between two different media. Medium 1($z < 0$) is filled with a material whose $\mu = 6$ and medium 2($z > 0$) whose $\mu = 4$. If the interface carries current $(1/\mu_0)\hat{a}_y$ mA/m and $\bar{B}_2 = 5\hat{a}_x + 8\hat{a}_z$ mWb/m². Find \bar{H}_1 and \bar{B}_1 . [8]

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]

OR

Q6) a) Explain the behavior of diamagnetic, paramagnetic and ferromagnetic materials in magnetic field with examples of each. [8]

b) Given a material for which $\chi_m = 3.1$ and within which $\bar{B} = 0.4y\hat{a}_z$ T, find: [8]

- | | | |
|--------------|-----------|--------------|
| i) \bar{H} | ii) μ | iii) μ_r |
| iv) M | v) J | vi) J_b |

Q7) a) Using Faraday's law, explain with help of diagram the concept of transformer emf and motional emf. [8]

b) In free space $\bar{E} = 20\cos(\omega t - 50x)\hat{a}_y$ V/m. Calculate \bar{J}_d, \bar{H} . [8]

OR

Q8) a) State the Maxwell's equation in integral form for static fields. Derive an equation for displacement current density. [8]

b) State the point form and integral form of Maxwell's equation for time varying fields. [8]

Q9) a) What is Poynting vector? What is its significance? Derive the expression of Poynting vector? [10]

b) Derive the wave equations for a lossy dielectric medium. [8]

OR

Q10) a) What is uniform plane wave? State and explain Maxwell's equation in phasor form for time harmonic electromagnetic fields in a linear, isotropic and homogenous medium. [10]

b) Write the properties of plane waves in good conductors. Explain the concept of skin effect. [8]

