Total No. of Questions : 10]

SEAT No. : ____

P3525

[Total No. of Pages : 2

[4959]-1069
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/m^2 **[6]**

b) If $\bar{J} = \frac{1}{r^3}\left(2\cos\theta\hat{a_r} + \sin\theta\hat{a_\theta}\right) A/m^2$,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 $\bar{E}$. **[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_o 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 $\hat{a_\phi}$. 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 μ=6 and medium 2(z>0) whose μ=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/m^2. Find $\overline{H_1}$ and $\overline{B_1}$. **[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 χ_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 $\bar{E}$ =20cos(ωt–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]**