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10ES36

# Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
## Field Theory

Time: 3 hrs. Max. Marks:100

**Note:** ***Answer FIVE full questions, selecting at least TWO questions from each part.***



### PART – A

1 a. State Coulombs law for the Force between any two point charges and indicate the units of Quantities in the force equation. **(06 Marks)**

b. On the line described by x = 2m, y = –4m there is uniform charge distribution of density $\rho_L = 20$ nc/m. Determine Electric field at P(–2, –1, 4)m. **(04 Marks)**

c. State and prove Gauss – Divergence theorem. **(10 Marks)**

2 a. Given the potential field $V = (50x^2yz + 20y^2)$ Volts in free space.
Find : i) V at P(–2, 3, 6) ii) $\overline{E}_p$ and iii) $\hat{a}r$ at P **(06 Marks)**

b. Derive an expression for energy expended by moving a point charge arbitrarily in an uniform electric field. **(06 Marks)**

c. Derive Laplace and Poisson's equations starting from the differential form of Gauss law. Express Laplace equation in all the three co-ordinate systems. **(08 Marks)**

3 a. Derive expression for energy stored in a capacitor and an expression after energy density in an electrostatic field. **(08 Marks)**

b. In cylindrical coordinate system planes are insulated along 'z' axis as shown in Fig 3(b). Neglect fringing effect and find expressions for $\vec{E}$ between the planes assuming a potential of 100V for $\phi = \alpha$ and a zero reference at $\phi = 0$. **(06 Marks)**

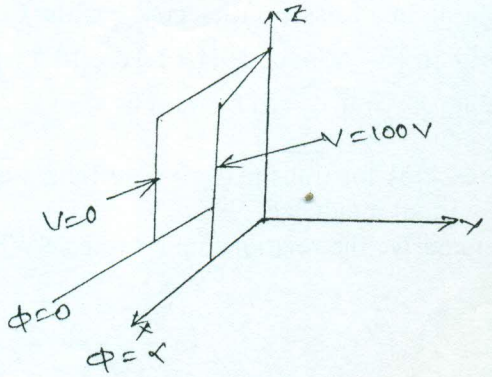


Fig Q3(b)

c. State and prove uniqueness theorem. **(06 Marks)**

4 a. An air cored torroid having a cross sectional area of $6cm^2$ and mean radium 15cm is wound uniformly with 500 turns carrying a current of 4A. Determine the magnetic flux density and field intensity of torroid. **(06 Marks)**

b. Derive an expression for Magnetic flux density at any point on the axis of Solenoid. **(08 Marks)**

c. State and explain Amperes circuital law. **(06 Marks)**

## PART – B

5 a. Explain the concept of scalar and vector magnetic potential. **(08 Marks)**

b. Derive the boundary conditions at the interface between two different magnetic materials. **(06 Marks)**

c. Find the magnetic field intensity at the point P for the Fig Q5(c) shown below. **(06 Marks)**

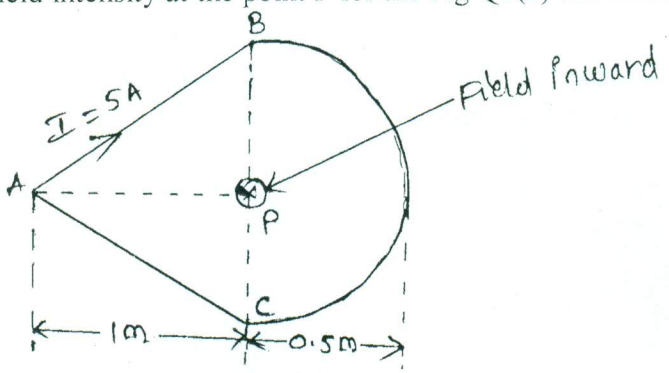


Fig Q5(c)

6 a. List out Maxwell's equations in point and integral forms for both static and time varying fields. **(08 Marks)**

b. Describe the continuity equation of current in differential form. **(06Marks)**

c. Show that conduction current in the wire is equal to the displacement current in the dielectric of a capacitor subjected to a time varying field. **(06 Marks)**

7 a. Explain how uniform plane wave is transverse in nature. Describe the skin depth or depth of penetration. **(10 Marks)**

b. A wave propagating in a Lossless dielectric has the Components.
$\vec{E} = 500\cos[10^7 t - \beta z]\,\hat{a}_z$ V/m and $\vec{H} = 1.1\cos[10^7 t - \beta z]\hat{a}_y$ A/m of the wave is travelling at V = 0.5C. Find : i) $\mu_r$ ii) $\epsilon_r$ iii) $\beta$ iv) $\lambda$ v) z. **(10 Marks)**

8 a. Derive the expressions for transmission co-efficient and reflection co-efficient of a uniform plane wave for normal incidence. **(10 Marks)**

b. Define SWR and derive the relationship between SWR and reflection coefficient. **(10 Marks)**

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