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4E 2088

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4E 2088

B.Tech. IV Semester (Main/Back) Examination - 2012

Electrical and Electronics Engineering

4EX6.1 Electro Magnetic Field Theory

EX, EI, BM, EC

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **Five questions** selecting **one question** from **each unit**. All questions carry **equal marks**. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.) Units of quantities used/calculated must be stated clearly.*

Unit - I

1. a) Write and state the Green's theorems. **(8)**

b) **An electric field intensity is given as** **(8)**

$$\vec{E} = \frac{100\ Cos\ \theta}{r^3}\ \vec{a_r} + \frac{50\ Sin\ \theta}{r^3}\ \vec{a_\theta}$$ then

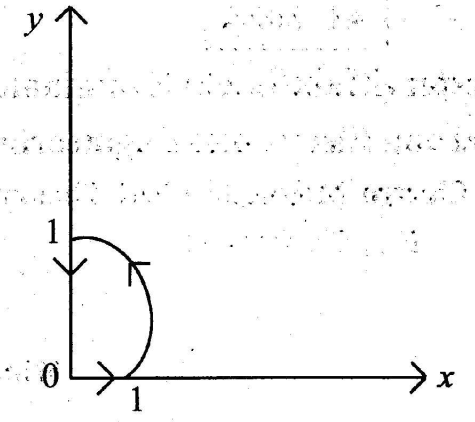
i) Find $|\vec{E}|$ at $r = 2$, $\theta = 60^0$, $\phi = 20^0$

ii) Unit vector in Cartesian Coordinates in the direction of $\vec{E}$.

OR

a) A vector field $\vec{D} = \left(\frac{5r^2}{4}\right)\vec{a_r}$ is given in spherical Coordinates. Evaluate both sides of Divergence theorem for the volume enclosed between $r = 1$ and $r = 2$. **(8)**

b) Given $\vec{A} = 2r\ Cos\ \phi\ \vec{a_r} + r\vec{a\phi}$ in cylindrical Coordinates. For the path shown in figure verify Stokes's theorem. **(8)**



Unit - II

2. a) State and prove the Uniqueness theorem. **(8)**

b) Use Laplace's equation to find the capacitance per unit length of a Coaxial. Cable of inner radius '*a*' meter and outer radius '*b*' meter. Assume $V = V_0$ at $r = a$ and $V = 0$ at $r = b$. **(8)**

OR

2. a) A cylindrical Capacitor has radii $a = 1$ cm and $b = 2.5$ cm. If the space between the plates is filled with an inhomogeneous dielectric with $\varepsilon_r = (100 + e)/e$, where '*e*' is in Centimeters find the capacitance per meter of the capacitor. **(8)**

b) Explain the boundary conditions and determine them for

i) Dielectric - Dielectric

ii) Conductor - Dielectric

iii) Conductor - free space. **(8)**

Unit - III

3. a) Briefly explain the Ampere's law and using it, find the $\overline{H}$ due to infinite sheet of current. **(8)**

b) In the region $0 < r < 0.5m$, in cylindrical Coordinates, the current density is $\vec{J} = 4.5\, e^{-2r}\ \vec{a_z}\ A/m^2$ And $\vec{J} = 0$ else where. Use Amperes circuital law to find $\overline{H}$. **(8)**

OR

3. a) What is Magnetic field Mapping? Explain the concept of Field Cell in parallel strip transmission lines. **(8)**

b) A very long Solenoid with 2×2 cm Cross section has an iron core $(\mu_r = 1000)$ and 4000 turns/meter. If it carries current of 500 mA.

Find

i) Its self inductance per meter.

ii) The energy per meter stored in field. **(8)**

Unit - IV

4. a) Explain the Poynting Vector and Poynting theorem and find the average power density. **(8)**

b) Calculate intrinsic impedance η, the propagation constant γ and wave velocity v for a conducting medium in which $\sigma = 58\, Ms/m$, $\mu_r = 1$, $\varepsilon_r = 1$ at a frequency of 100 MHz. **(8)**

OR

4. a) A parallel plate Capacitor with plates area of $5cm^2$ and plate separation of 3mm has a voltage of $(50 \sin 10^3 t)$ volts applied to its plates. Calculate the displacement current, assuming $\varepsilon = 2\varepsilon_0$. **(8)**

b) What is uniform plane? Find the expression for intrinsic impedance for

i) **Perfect dielectric**

ii) Lossy dielectric. **(8)**

Unit -V

5. a) What is Hertzian dipole? Write the relation between a current element and an electric dipole using suitable expression. **(8)**

b) Calculate the radiation resistance of a $\frac{\lambda}{100}\, m$, $\frac{\lambda}{y}$ monopole and half wave dipole antennas. **(8)**

OR

5. a) Explain with the help of diagram different modes of EMI coupling. **(4)**

b) Write the methods of eliminating EMI and briefly explain any of two. **(8)**

c) What is retarded potentials explain briefly. **(4)**