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Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, NOVEMBER 2013

EC 09 503—ELECTROMAGNETIC FIELD THEORY

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

Each question carries 2 *marks.*

1. Determine the divergence of the vector field $\vec{A} = p\sin\phi\,\vec{a}_p + p^2 z\,\vec{a}_p + z\cos\phi\,\vec{a}_z$.
2. The point charges −1nC, 4nC and 3nC are located at $(0,0,0)$, $(0,0,1)$ and $(1,0,0)$ respectively. Find the energy in the system.
3. State Poynting theorem.
4. What is skin depth ?
5. What is meant by characteristic impedance of transmission line ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*
Each question carries 5 *marks.*

1. If $\vec{A} = p\cos\phi\,\vec{a}_p + \sin\phi\,\vec{a}_\phi$. Verify Stokes theorem when P = 2 and ϕ varies from 60° to 30°.
2. Derive the expression for Electric flux density due to infinite sheet of charge using Gauss's law.
3. Derive the Maxwell's equation for a time varying field from Ampere's circuit law.
4. Write in brief the conditions for linear polarization and circular polarization of a wave.
5. Derive the Poynting's theorem.
6. Explain in brief Skin effect.

(4 × 5 = 20 marks)

Part C

Answer **all** *questions.*
Each question carries 10 *marks.*

1. Find the volume defined by $4 < p < 6$, $30° < \phi < 60°$ and $2 < z < 5$. What is the length of the longest straight line that lies entirely within the volume and find the total area of the surface.

(3 + 3 + 4 = 10 marks)

Or

2. Derive the boundary conditions at the interface separating two different dielectric media in Electric field.

Turn over

3. Derive the expression for displacement current density.

Or

4. Two conducting cones $\left(\theta = \pi/10\right.$ and $\left.\theta = \pi/6\right)$ of infinite extent are separated by an infinitesimal gap at $r = 0$. If $V\left(\theta = \pi/10\right) = 0$ and $V\left(\theta = \pi/6\right) = 50$ V, find potential and Electric field intensity between the cones using Laplace's equation.

5. Derive the expression for Electric field Intensity and Magnetic field Intensity due to plane waves in lossy dielectrics.

Or

6. Derive the expression for total time average power crossing a surface S from Poynting's theorem.

7. Derive the expressions for propagation constant, wave velocity and characteristic impedance of a lossless transmission line.

Or

8. Derive the field components of TM mode of propagation in Rectangular waveguide.

(4 × 10 = 40 marks)