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**Question Paper Code : 80525**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Fourth Semester

Electronics and Communication Engineering

EC 8451 – ELECTROMAGNETIC FIELDS

(Common to: Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the Differential Length, surface, volume of Cylindrical and Spherical coordinate systems.
2. Prove that curl of gradient is zero.
3. A charge is distributed on x axis of Cartesian system having a line charge density of  $3x^2 \mu C/m$ . Find the total charge over the length of 10m.
4. Write down the expression for Electric field intensity due to various charge distributions.
5. State Lorentz force equation.
6. Two wires carrying current in the same direction of 3A and 6A are placed with their axis 5cm apart. Calculate the force between them.
7. Find the amplitude of displacement current density inside a capacitor where  $\epsilon_r = 600$  and  $D = 3 * 10^{-6} \sin(6 * 10^6 t - 3464x) a_z c/m^2$ .
8. State Faraday's law.
9. Define skin Effect.
10. Define Brewster angle.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Given  $H = 2.5a_\theta + 5a_\phi$  in spherical coordinates. Find Curl of H at  $(2, \pi/6, 0)$ . (8)
- (ii) Transform the vector  $A = ya_x - xa_y + za_z$  into cylindrical coordinates. (5)

Or

- (b) (i) Find Cartesian coordinates of vector field  $H = 20a_r - 10a_\phi + 3a_z$  (5)
- (ii) State and Prove stoke's Theorem and Divergence Theorem. (8)
12. (a) A charge is distributed along an infinite straight line with constant density  $\rho$  C/m along Z axis. Develop an expression for Electric Field Intensity at an arbitrary point. (13)

Or

- (b) (i) Determine the capacitance between two transmission lines. (8)
- (ii) Explain in detail about boundary conditions for electric field. (5)
13. (a) Derive the expression for magnetic field intensity in the axis of Circular Disc. (13)

Or

- (b) Show that the inductance of the cable is  $L = \mu 1/2\pi \ln(b/a)$ . (13)
14. (a) Derive Maxwell's equation in Point form, Integral form and Phasor form/Harmonically time varying field. (13)

Or

- (b) Derive the expression for Electromagnetic wave equation. (13)
15. (a) Derive Transmission and Reflection Coefficient for the Plane waves that Incident oblique on Dielectric boundary. (13)

Or

- (b) Derive the expression of uniform plane waves in conducting medium. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Four Point charges of  $10\mu C$  are placed in free space at the points (1,0,0) (-1,0,0), (0,1,0) and (0,-1,0)m respectively Determine Force on a point charge of  $30\mu C$  located at a point (0,0,1). (15)

Or

- (b) (i) Determine magnetic field intensity H at P (0.4,0.3,0) in the field of an 8A filamentary current directed inward from infinity to the origin on the positive x axis, and then outward to infinity along the positive y axis. (10)
- (ii) A solenoid has an inductance of 20mH. If the length of solenoid is increased by two times and radius is increased by half of its original value. Find the new inductance. (5)
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