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Question Paper Code : 20930

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fourth Semester

Electronics and Communication Engineering

EC 3452 – ELECTROMAGNETIC FIELDS

(Common to Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define scalar field.
2. State Divergence theorem.
3. Define electric flux density.
4. List two applications of Gauss's Law.
5. Differentiate static electric and magnetic field lines.
6. What is a torque?
7. State Faraday's law.
8. What is potential difference?
9. What is group velocity?
10. List four properties of good conductors.

PART B — (5 × 13 = 65 marks)

11. (a) Given, $A = (\sin 2\varphi) a_\varphi$ in cylindrical co-ordinates. Find curl of A at $(2, \pi/4, 0)$. (13)

Or

- (b) Given the two points, $A(x = 2, y = 3, z = 1)$ and $B(r = 2, \theta = 20^\circ, \varphi = 220^\circ)$. Find
- (i) Spherical co-ordinates of A (7)
 - (ii) Cartesian co-ordinate of B . (6)

12. (a) 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 10 m. (13)

Or

- (b) If $V = x - y + xy + 2z$ V, Find
- (i) E at (2, 2, 1) (7)
- (ii) Energy stored in a cube of side 1m centered at the origin. (6)
13. (a) Obtain the expression for magnetic field intensity on an axis of a circular ring. (13)

Or

- (b) Find the magnetic field intensity at a point P, due to a finite straight conductor, carrying a current I. (13)
14. (a) Derive wave equation, and explain the properties of uniform plane waves in free space. (13)

Or

- (b) Derive and explain, Maxwell's equations both in integral and point forms. (13)
15. (a) Derive pointing vector in integral and point form from Maxwell's equation. (13)

Or

- (b) Explain the reflection of plane wave by conducting medium, under normal incidence. (13)

PART C — (1 × 15 = 15 marks)

16. (a) (i) A conductor 6m long, lies along Z direction with a current of 2A in a_z direction. Find the force experienced by conductor if $B = 0.08 a_x(T)$. (8)
- (ii) Find the maximum torque on an 85 turns, rectangular coil with dimension $(0.2 \times 0.3)m$, carrying current of 5 Amps in a field $B = 6.5T$. (7)

Or

- (b) (i) Position of a point P is $(8, 120^\circ, 330^\circ)$. Express in cylindrical co-ordinate system. (7)
- (ii) Determine the divergence of the vector field $\vec{P} = x^2 yz \vec{a}_x + xz \vec{a}_z$. (8)