Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

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 $B = (r = 2, \theta = 20°, \varphi = 220°)$. 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°, 330°). 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)

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