Reg. No. : | | | | | | | | | | | | |

**Question Paper Code : 20974**

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

Third Semester

Electrical and Electronics Engineering

EE 3301 – ELECTROMAGNETIC FIELDS

(Regulations – 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define vector field.

2. List two applications of Gauss's law.

3. Write the Poisson's equation.

4. Relate electric field intensity and electric flux density.

5. State Biot-Savarts law.

6. State Amperes circuit law.

7. What is mutual inductance of coils?

8. State Faradays law.

9. What is group velocity?

10. Define skin depth.

PART B — (5 × 13 = 65 marks)

11. (a) Determine the divergence of the vector field. $\vec{P} = x^2 yz\vec{a}_x + xz\vec{a}_z$. (13)

Or

(b) Given the two points $A\ (x = 5, y = 7, z = 3)$ and $B = (r = 6, \theta = 40°, \varphi = 220°)$. Find

(i) Spherical co-ordinate of A. (7)

(ii) Cartesian co-ordinate of B. (6)

12. (a) A cylindrical capacitor consists of an inner conductor of radius 'a' and an outer conductor, whose inner radius is 'b'. The space between the conductors is filled with a dielectric permittivity $\varepsilon_r$ and length of the capacitor is L. Find the value of the capacitance. (13)

Or

(b) If $V = x - y + xy + 4z\ V$, Find

(i) E at (4,4,4) (7)

(ii) Energy stored in a cube of side 1 m centered at the origin. (6)

13. (a) Derive the boundary conditions, for the EM wave in magnetic field to travel between two different mediums. (13)

Or

(b) Derive the magnetic field intensity at a point P due to a finite straight conductor, carrying a current I. (13)

14. (a) Derive displacement current from circuital analysis and from Ampere circuital law. (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) Derive wave equation and explain the properties of uniform plane waves in free space. (13)

PART C — ($1 \times 15 = 15$ marks)

16. (a) Find the total charge inside a volume having charge density as $10\ z^2\ e^{-0.1x}\ Sin\ \pi\ y\ C/m^3$. The volume is defined between $-2 \leq x \leq 2$, $0 \leq y \leq 1$ and $3 \leq z \leq 4$. (15)

Or

(b) Determine, whether the following potential fields satisfy the Laplace's equations:

(i) $V = x^2 - y^2 + z^2$ (5)

(ii) $V = r \cos \varphi + z$ (5)

(iii) $V = r \cos \theta + \varphi$ (5)