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

Question Paper Code : 70512

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

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. List the three co-ordinate systems.
2. State Stokes theorem.
3. State Coulomb's Law.
4. What is the relation between Electric Flux Density and Electric Field Intensity?
5. Write two applications of Biot-Savart law.
6. State Ampere's circuital law.
7. State Faraday's law of electromagnetic induction.
8. What is displacement current?
9. Outline the importance of Poynting vector.
10. What is the intrinsic impedance of air?

PART B — (5 × 13 = 65 marks)

11. (a) Derive the electric field due to infinite line charge with charge density ρL. (13)

Or

(b) For a vector field A, show explicitly that $\nabla.\nabla \times A = 0$ that is, the divergence of curl of any vector field is zero. (13)

12. (a) Explain boundary conditions for electric fields between conductor and free space. (13)

Or

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

13. (a) Using Biot-Savart's law, derive the magnetic field intensity on the axis of a circular loop of radius R carrying a steady current I. (13)

Or

(b) Formulate the magnetic flux density around infinitely long straight conductor by magnetic vector potential. (13)

14. (a) Derive pointing vector in integral and point form from Maxwell's equation. (13)

Or

(b) Derive displacement current from circuital analysis and from Ampere circuital law. (13)

15. (a) Derive the attenuation constant, phase constant, phase velocity and intrinsic impedance for free space, dielectric and perfect conductors. (13)

Or

(b) Find the refection and transmission coefficient of a plane wave in oblique incident at a boundary of two dielectric mediums. (13)

PART C — (1 × 15 = 15 marks)

16. (a) If the vector magnetic potential is given by

$\vec{A} = \frac{10}{x^2 + y^2 + z^2} a_x$ Obtain the magnetic flux density in vector form. (15)

Or

(b) If $V = \left[2x^2y + 20z - \frac{4}{x^2 + y^2}\right]$ volts. Evaluate $\vec{E}$ and $\vec{D}$ at point $P(6, -2, 5, 3)$. (7 + 8)