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

Question Paper Code : 91030

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

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 electrostatic discharge.
2. List the types of coordinate system.
3. List the boundary conditions for electric field.
4. Write the Laplace equation in spherical coordinates.
5. State Biot-Savart law.
6. Write the relation between magnetic field intensity and magnetic flux density.
7. Compare circuit theory and field theory.
8. Define displacement current.
9. Define skin depth.
10. Prove that the intrinsic impedance of free space is 377 ohm.

PART B — (5 × 13 = 65 marks)

11. (a) (i) State and prove divergence theorem. (6)

(ii) Obtain the expression for electric field intensity on axis of a uniformly charged circular disc. (7)

Or

(b) (i) Derive an expression for magnetic Gauss Law in point form and integral form. (8)

(ii) State and explain Coulomb's law. (5)

12. (a) (i) Derive an expression for the capacitance of a parallel plate capacitor with two dielectric media. (7)

(ii) Discuss briefly about the nature of dielectric materials. (6)

Or

(b) (i) Explain the potential due to charged disc. (6)

(ii) Derive the equation for energy stored by a capacitor. (7)

13. (a) (i) Derive an expression for the force between the two current carrying wires. Assume that the currents are in the same direction. (6)

(ii) Determine the force per meter length between two long parallel wires A and B separated by 5cm in air and carrying currents of 40 amperes in the same direction. (7)

Or

(b) (i) Obtain the expression for magnetic field intensity at a center of a circular wire. (6)

(ii) Obtain the expression for magnetic field intensity at a center of a square current loop. (7)

14. (a) (i) Explain briefly about the motional emf and derive an expression for it. (6)

(ii) Derive Maxwell's equations from Ampere's Law in integral and point forms. (7)

Or

(b) Explain the following terms:

(i) Magneto motive force. (6)

(ii) Flux of magnetic circuit. (7)

15. (a) (i) Explain about the propagation of EM waves in good conductor. (6)

(ii) Discuss about Poynting vector and power flow. (7)

Or

(b) (i) Obtain the expression for instantaneous power flow per unit area. (6)

(ii) Describe about the propagation of plane waves in lossy dielectric. (7)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Derive an expression for inductance of a solenoid with N turns carrying a current of I amperes. (7)

(ii) Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of 6cm diameter. The length of the tube is 60cm and the solenoid is in the air. (8)

Or

(b) (i) Obtain the expression for the inductance of a toroid. (7)

(ii) Obtain the boundary relations which hold good for the interface of two different magnetic materials. (8)