

[Total No. of Questions - 9] [Total No. of Printed Pages - 3]  
(2125)

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**B. Tech 4th Semester Examination**  
**Electromagnetic Field Theory (OS)**  
**EE-4003**

**Time : 3 Hours**

**Max. Marks : 100**

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt five questions in all, selecting one question from each section A, B, C and D and all the subparts of the Section E. All questions carry equal marks and assume missing data if any suitably.

**SECTION - A**

1. (a) Convert point P(1, 3, 5) from cartesian to cylindrical & spherical co-ordinates. (6)
- (b) Explain the physical Interpretation of the term:
  - (i) Divergence of a vector field
  - (ii) Curl of the vector field. (8)
- (c) State and Explain the Coulomb's law. (6)
2. (a) State Gauss's law. Deduce Coulomb's law from Gauss's law thereby affirming that Gauss's law is an alternative statement of Coulomb's law and that Coulomb's law is implicit in Maxwell's equation. (14)
- (b) Derive the expression for energy stored in a capacitor, when an electric field E is present. (6)

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**SECTION - B**

3. (a) Describe Faraday's laws of electromagnetic induction. Show that one of the Maxwell's equations follow from the same. (8)
- (b) State Ampere's work law in differential vector form. Discuss in detail applications of Ampere's law. (12)
4. (a) Derive and explain the equation of continuity. (10)
- (b) A stroke of lightning may be regarded as a filamentary line current. If a lightning stroke with current 50 kA occurs 100 m away from your house, calculate the magnetic flux density at your house due to the lightning stroke. (10)

**SECTION - C**

5. (a) Deduce the Maxwell's equations for sinusoidally time varying fields and explain their physical significance. (8)
- (b) Derive the relation between E and H in uniform plane wave propagation. Define intrinsic impedance and give its physical significance. (12)
6. (a) What do you mean by uniform plane electromagnetic wave? Show that uniform plane wave is transverse in nature. (10)
- (b) Define the depth of penetration of an electromagnetic wave and find an expression for it in case of a good conductor. (10)

**SECTION - D**

7. (a) What do you mean by reflection coefficient and voltage standing wave ratio of a transmission line? Derive an expression for the input impedance of a transmission line of characteristic impedance  $Z_0$  and length l, when terminated by impedance  $Z_L$ . (12)

- (b) A telephone line has resistance of 20 ohms, inductance of 10 mH, capacitance of 0.1  $\mu$ F and insulation resistance of 0.1 mega ohm/km. Find the input impedance at angular frequency of 5000 radian/sec, if the line is very long. (8)
8. (a) State and explain Poynting theorem. (10)
- (b) Discuss significance and applications of Smith's chart. (10)

**SECTION - E**

9. (a) What is analogy between electric and magnetic field?
- (b) State the condition for the field to be realizable as static magnetic field.
- (c) State Stokes theorem.
- (d) Differentiate between scalar and magnetic vector potential.
- (e) What happens if the length of transmission line is infinite?
- (f) Draw radio frequency equivalent circuit representation of a transmission line.
- (g) Is resistance in transmission line dependent on the dielectric constant of the medium between the conductors? Comment.
- (h) Why Ampere's law was modified?
- (i) If the reflection coefficient in a transmission line for a given load is  $0.5+j0.5$ , then what is the VSWR?
- (j) Is there any phase distortion for propagation in a uniform transmission line? Comment. (2×10=20)