

D 51025

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**THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
NOVEMBER 2013**

EE 09 304/PT EE 09 303—ELECTROMAGNETIC FIELD THEORY

Time : Three Hours

Maximum : 70 Marks

Part A

Answer all questions.

1. What are the various types of charge distributions. Give an example of each.
2. Calculate inductance of a uniform toroidal coil with 200 turns, having a mean diameter of 20 cm wound on a core having a diameter of 2 cm.
3. Plot the variation of magnetic field intensity H inside and outside a circular conductor with uniform current density.
4. Given $E = E_m \cos (wt - kz)a_x$ in free space, sketch E and H at $t = 0$.
5. What is characteristic impedance of a transmission line ?

(5 × 2 = 10 marks)

Part B

Answer any four out of six questions.

6. Find the value of the constants a , b and c so that the vector

$$E = (x + 2y + az) a_x + (bx - 3y - 2) a_y + (4x + cy + 2z) a_z \text{ is irrotational.}$$

7. State and prove Gauss' law and mention the applications.
8. At a point $P(x, y, z)$ the components of vector magnetic potential A are given as

$$A_x = (x + 4y + 2z) ; A_y = (2x + 4y + 3z) \text{ and } A_z = (x + 3y + 2z). \text{ Determine flux density } B \text{ at a point } P(1, -1, -1).$$

9. Explain Faraday's laws of electromagnetic induction.
10. Explain the role of displacement current in Maxwell's equations.
11. What is meant by stub matching ?

(4 × 5 = 20 marks)

Turn over

Part C*Answer all questions.*

12. (a) (i) Determine divergence and curl of the vector $A = x^2 a_x + 2y a_y + zy a_z$.
 (ii) Define electric potential and potential difference.

(6 + 4 = 10 marks)

Or

- (b) (i) Verify the Laplace's equation for the following potential $V = 15x^2yz - 5y^3z$.
 (ii) Derive the expression for energy density in electrostatic fields.

(6 + 4 = 10 marks)

13. (a) (i) Deduce the magnetic boundary conditions.
 (ii) Differentiate between self inductance and mutual inductance.

(6 + 4 = 10 marks)

Or

- (b) (i) Derive an expression for torque on a closed loop carrying a current I .
 (ii) Write a short note on permeability.

(7 + 3 = 10 marks)

14. (a) Derive wave equation in free space in phasor form.

Or

- (b) (i) Calculate intrinsic impedance η , propagation constant γ and wave velocity v for a conducting medium in which $\sigma = 58 \text{ MS/m}$, $\mu_r = 1$, $\epsilon_r = 1$ at a frequency of 10 MHz.
 (ii) Write a short note on Poynting vector.

(5 + 5 = 10 marks)

15. (a) Derive the propagation constant in transmission line.

Or

- (b) Write short notes on :
 (i) Voltage reflection coefficient and
 (ii) Snell's Law.

(5 + 5 = 10 marks)

(4 × 10 = 40 marks)