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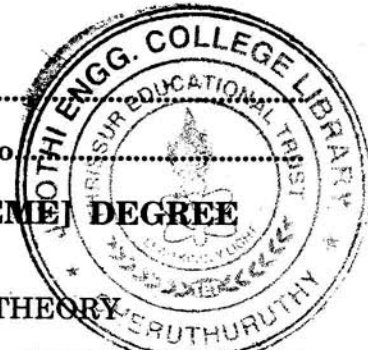
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**THIRD SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE
EXAMINATION, NOVEMBER 2014**

EE 09 304/PTEE 09 303—ELECTROMAGNETIC FIELD THEORY

Time : Three Hours

Maximum : 70 Marks



Part A

Answer all questions.

1. The electric potential V of the system is given by $V = 2x^2y - 5z$. Determine the electric field intensity E at a point $P(2, -1, 3)$.
2. State Ampere's circuital law.
3. Define elliptical polarization.
4. Mention the significance of Brewster angle.
5. What are the applications of Smith Chart ?.

(5 × 2 = 10 marks)

Part B

Answer any four out of six questions.

6. Verify the divergence theorem for a vector for a vector field $D = 3x^2 a_x + (3y + z)a_y + (3z - x)a_z$ in the region bounded by the cylinder $x^2 + y^2 = 9$ and the planes $x = 0, y = 0$ and $z = 2$?
7. Deduce the boundary conditions for dielectric-dielectric interface ?
8. Derive the force and torque in a magnetic field using electric motor as an example.
9. From the fundamentals, derive the Maxwell's equations in differential form.
10. Determine the conduction current density and displacement current density in a conductor having $\sigma = 50 \text{ MS/m}$, $\epsilon_r = 1$ when $E = 100 \sin 100 \pi t$?
11. Write short note on double stub matching.

(4 × 5 = 20 marks)

Part C

Answer all questions.

12. (a) (i) Prove that $\text{curl grad } F = 0$.
- (ii) A uniform surface charge of $\rho_s = 100 \mu\text{C} / \text{m}^2$ is situated at $z = 3$ plane. What is the value of electric flux density at a point $P(2, 5, -5)m$.

(4 + 6 = 10 marks)

Or

Turn over

- (b) (i) Derive an expression for capacitance of a spherical capacitor with conducting shells of radius a and b ?
 (ii) Obtain an expression for energy density in a capacitor ? (6 + 4 = 10 marks)

13. (a) (i) State and explain Biot-Savart Law.

- (ii) Calculate magnetic field intensity H at a point $P(1, 1, -1)$ due to a current element of length 2 mm located at the origin in free space with a current of 10 mA in $+y$ direction ?

(4 + 6 = 10 marks)

Or

- (b) (i) Derive the relation between magnetic flux density B and vector potential A ?

(ii) What are the applications of Toroid ? (7 + 3 = 10 marks)

14. (a) (i) Write a short note on Poynting theorem ?

- (ii) Prove that time varying field is not conservative ? (6 + 4 = 10 marks)

Or

- (b) A plane travelling wave has a peak electric field intensity E as 10 kV/m in the lossless medium with $\mu_r = 1$, $\epsilon_r = 5$. Determine the velocity of the electromagnetic wave, intrinsic impedance of the medium and the magnetic field H . Derive all the formulae used.

(10 marks)

15. (a) Write short notes on :

(i) Transmission line parameters; and

(ii) Standing wave ratio.

(5 + 5 = 10 marks)

Or

- (b) Derive the transmission and reflection coefficients at the interface of two media for normal incidence. (10 marks)

[4 × 10 = 40 marks]