C 1267 (Pages : 2) Name............................
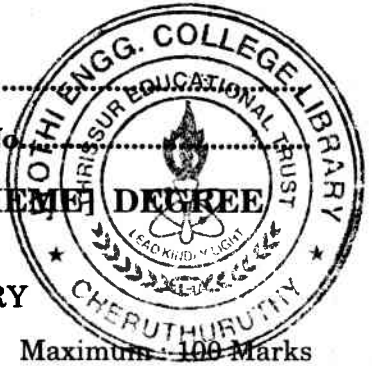
Reg. No.........................

FOURTH SEMESTER B.TECH. (ENGINEERING) [14 SCHEME] DEGREE EXAMINATION, APRIL 2016

EE 14 406—ELECTROMAGNETIC FIELD THEORY

Time : Three Hours Maximum : 100 Marks

Part A

Answer any **eight** *questions.*

1. Name the different co-ordinate systems and explain any *one* of the coordinate systems.

2. Define the Gauss law and list its application.

3. State and explain the Divergence theorem.

4. Explain the Kirchhoff's law.

5. Write short notes on magnetic scalar potential.

6. Derive the expression of energy stored in an inductor in terms of magnetic field quantities.

7. Explain the concept of 'Displacement Current'. How is this current different from conduction current ?

8. With necessary explanation, derive the Maxwell's equation indifferential Forms.

9. Define uniform plane wave propagation and discuss its properties.

10. Derive the transmission and reflection coefficients for the electromagnetic waves.

(8 × 5 = 40 marks)

Part B

Answer **all** *questions.*

11. (a) Using Divergence theorem, evaluate $\iint E.ds = 4xz\,ax - y^2\,ay + yzaz$ over the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$.

(15 marks)

Or

(b) (i) Derive Poisson's and Laplace's equations. (7 marks)

(ii) Three concentrated charges of $0.25\,\mu C$ are located at the vertices of an equilateral triangle of 10 cm side. Find the magnitude and direction of the force on one charge due to other two charges.

(8 marks)

Turn over

12. (a) Derive an expression for the inductance of solenoid and toroid.   (15 marks)

Or

(b) (i) Show by means of Biot Savart's law that the flux density produced by an infinitely long straight wire carrying a current I at any point distant a normal to the wire is given by $\mu_0 \, \mu_r I/2\pi a$.

(7 marks)

(ii) What is the maximum torque on a square loop of 1000 turns in a field of uniform flux density B tesla ? The loop has 10 cm sides and carries a current of 3A. What is the magnetic moment of the loop ?

(8 marks)

13 (a) Develop an expression for induced e.m.f. of Faraday's disc generator.   (15 marks)

Or

(b) Derive and explain the Maxwell's equations in point form and integral form using Ampere's circuital law and Faraday's law.

(15 marks)

14. (a) A uniform plane wave in a medium having $\delta = 10^{-3} \, s/m$, $\varepsilon = 80 \, \varepsilon_0$ and $\mu = \mu_0$ is having a frequency of 10 KHz :

(i) Verify whether the medium is good conductor.

(ii) Calculate the following :

1 Attenuation constant

2 Phase constant

3 Propagation constant

4 Intrinsic impedance

5 Wave length

6 Velocity of propagation.

(15 marks)

Or

(b) Derive the transmission and reflection coefficients for the electromagnetic waves. Discuss the above for an open line and a short circuited line.

(15 marks)

[4 × 15 = 60 marks]