Reg. No.

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Third Semester

Electrical and Electronics Engineering

EE 6302 – ELECTROMAGNETIC THEORY

(Regulations 2013)

Time : Three Hours   Maximum : 100 Marks

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. What is Electric field intensity ?

2. State Gauss's Law.

3. What is a capacitor and capacitance ?

4. Write Poisson's equation in cylindrical co-ordinates.

5. State Ampere's Circuital Law.

6. Write magnetic boundary conditions.

7. State Faraday's law of Electromagnetic induction.

8. What is meant by displacement current ?

9. What is Skin depth ?

10. Write poynting vector.

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Three point charges in free space are located as follows : 50 nC at (0,0) m; 40 nC at (3,0) m ; – 60 nC at (0, 4) m. Find the electric field intensity at (3, 4) m. **(8)**

    (ii) A charge is distributed along a finite straight line with constant density ρ C/m along " X axis. Develop an expression for E at an arbitrary point P. **(8)**

OR

    (b) (i) A charge Q1 = 100 nC is located in vacuum at P1 (– 0.03, 0.01, 0.04) m. Find the force on Q1 due to (i) Q2 = 120 µC at P2 (0.03, 0.08, –0.02) m (ii) Q3 = 120 µC at P3 (–0.09, –0.06, 0.10) m (iii) Q2 and Q3. **(8)**

    (ii) Explain divergence and curl of a vector. **(8)**

12. (a) (i) Develop an expression for the capacitance of parallel plate capacitor having two different dielectric media. **(8)**

    (ii) Explain the potential at a point in an electric field. Derive the electric field intensity at any point in a field due to a point charge. **(8)**

OR

    (b) (i) Write Laplace's equation in cartesian co-ordinates. And obtain the solution when V is function of x only for the boundary condition $V = V_1$ at $x = x_1$ and $V = V_2$ at $x = x_2$. **(8)**

    (ii) Calculate the potential at a point P(0, 0) m due to point charges Q_1 and Q_2. $Q_1 = 10^{-12}$ Coulomb is located at (0.5, 0) m and $Q_2 = -10^{-11}$ Coulomb is located at (– 0.5, 0) m. **(8)**

13. (a) (i) Develop an expression for the magnetic field intensity at any point on the line through the centre at a distance 'h' m from the centre and perpendicular to the plane of a circular loop (in XY plane) of radius 'a' m and carrying a current I Ampere in the anti-clockwise direction. **(8)**

    (ii) Find the magnetic field intensity at Point P (1.5, 2, 3) caused by a current filament of 24 Ampere in the a_z direction on the z axis and extending from z = 0 to z = 6. **(8)**

OR

    (b) (i) Deduce the point form of Ampere's circuital law. **(8)**

    (ii) Determine the torque on a rectangular loop (a m × b m) carrying current I and placed in a uniform magnetic field. **(8)**

14. (a) Starting from the basic principle obtain Maxwell's equations in point and integral form.

OR

(b) Explain the relation between field theory and circuit theory.

15. (a) (i) Deduce the wave equations for conducting medium. (8)

(ii) Discuss group velocity, phase velocity and propagation constant of electromagnetic waves. (8)

OR

(b) (i) Deduce the expression for fields of a plane electromagnetic waves which are incident normally on the surface of a perfect dielectric medium. (10)

(ii) Write short note on standing waves. (6)

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