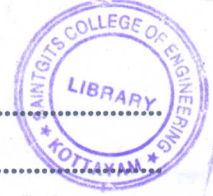


F 3103

(Pages : 3)

Reg. No.....

Name.....



B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch—Electrical and Electronics Engineering

ELECTROMAGNETIC THEORY (E)

(Prior to 2010 Admissions—Old Scheme)

[Supplementary/Mercy Chance]

Time : Three Hours

Maximum : 100 Marks

Part A

*Answer all questions briefly.
Each question carries 4 marks.*

1. Show how a point P is represented in a spherical co-ordinate system ?
2. State the various types of charge distributions, giving one example of each.
3. What is divergence ? State expressions for divergence in various co-ordinate system.
4. Define an electric dipole. State expression of \vec{E} due to an electric dipole.
5. Derive an equation for the capacitance per metre length of two long parallel conductors with radius R separated by distance d in air.
6. Explain the concept of field polarization in dielectrics.
7. Explain the concept of steady magnetic field and conduction current.
8. A charged particle passes through a magnetic field without experiencing any force. What can you conclude about the magnetic field ?
9. Explain how Faraday's law can be used to extend one of the Maxwell's equations from static to time-varying electromagnetic fields.
10. If $H = 5.5$ mA/m in a medium with $\epsilon_r = 3.3$ and $\mu = \mu_0$ at 300 MHz, calculate the average Poynting vector.

(10 × 4 = 40 marks)

Part B

*Answer all questions.
Each full question carries 12 marks.*

11. (a) Given the vector field $\vec{W} = 2x^2y \vec{a}_x - 2(z - x) \vec{a}_y + 3xyz \vec{a}_z$. Find (i) \vec{W} at P (2, -3, 4) ; (ii) Unit vector in the direction of \vec{W} at p ; (iii) The equation of surface on which the $\vec{W} = 100$; and (iv) the y-co-ordinate of Q (-3, y, 5) such that $|\vec{W} \text{ at Q}| = 100$ and $y > 0$.

Turn over

- (b) Find the electric field intensity at a point (0, 0, 5) meter due to two charges $Q_1 = 0.35 \mu\text{C}$ at (0, 4, 0) and $Q_2 = -0.55 \mu\text{C}$ at (3, 0, 0).

Or

12. (a) A uniform line charge of 20 nc/m is located at $y = 3, z = 6$ in free space. Find \vec{E} at :
- (i) (2, -1, 4) meter ; (ii) at the point in $z = 0$ plane where the direction of \vec{E} is $0.33 \vec{a}_y - 0.66 \vec{a}_z$.
- (b) A dipole of moment $\vec{p} = 6 \hat{a}_z \mu\text{C}\cdot\text{m}$ is located at the origin in free space. Find electric field intensity \vec{E} at (4, 20°, 0°).
13. (a) Verify that the expression for the potential due to an electric dipole satisfies the Laplace equation.
- (b) Determine the electric field intensity of an infinitely long, straight, line charge of a uniform density λ in air.

Or

14. (a) Derive Laplace's and Poisson's equations in relation with electrostatic field.
- (b) Given the potential field $V = 50x^2yz + 20y^2$ volts in free space. Find : (i) V at P (1, 2, 3) ; and (ii) E_p .
15. (a) Explain the condition at boundary between two dielectrics.
- (b) A parallel plate capacitor of 12 cm × 12 cm and $d = 1$ cm is charged to a potential of 1 kV with air as dielectric. Find the energy stored.

Or

16. Derive the expression for capacitance of a coaxial cable using Laplace's equation.
17. (a) Calculate the force per unit length between two parallel infinite conductors carrying current I Amp ; (i) in the same direction ; and (ii) in the opposite direction.
- (b) Calculate the inductance of a solenoid, if the radius is 5 cm, length is 40 cm, $N = 500$, $\mu_r = 1000$ and $I = 10\text{A}$.

Or



18. (a) State and explain Ampere's circuital law.
- (b) Two narrow circular coils A and B having a common axis, are placed 10 cm apart. Coil A has 10 turns of radius 5 cm with a current of 1.0 A passing through it. If the magnetic field at the centre of the coil A to be zero, what current should be passed through the coil B, if coil B has single turn with radius 7.5 cm ?
19. (a) Starting from Maxwell's equations, derive an expression for wave equation in \vec{H} for uniform plane waves in a conducting medium for sinusoidal time variations of the fields.
- (b) Write the phasor form of a uniform plane wave having a frequency of 1 GHz that is travelling in the $+x$ direction in a medium of $\epsilon = 12 \epsilon_0$ and $\mu = \mu_0$.

Or

20. (a) Explain the significance of Poynting vector theorem. Obtain complex Poynting vector theorem.
- (b) Explain the concept of uniform plane wave.

(5 × 12 = 60 marks)

