Register No.: .... Name: ....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (S), AUGUST 2023
ELECTRICAL AND ELECTRONICS ENGINEERING
(2020 SCHEME)

Course Code : **20EET204**

Course Name: **Electromagnetic Theory**

Max. Marks : **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Given point P (2,3, -1), find the spherical coordinate of point P.
2. State and prove Stoke's theorem.
3. State Coulomb's law and write the equation in vector form.
4. Explain equipotential surface.
5. Write short note on magnetic vector potential.
6. Derive Maxwell's equation in differential and integral form from Faraday's Law.
7. Explain skin effect and skin depth.
8. What are uniform plane waves? Explain.
9. What are the different parameters of the transmission line?
10. Explain the standing wave ratio of the transmission line.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Transform the vector $\bar{A} = 2\widehat{a_x} - 3\widehat{a_y} - 1\widehat{a_z}$ to cylindrical coordinate at point P (2,3,5). (7)

 b) Define curl and also determine the curl of a vector field $\bar{A} = \frac{1}{r^2}\cos\theta\widehat{a_r} + r\sin\theta\cos\phi\widehat{a_\theta} + \cos\theta\widehat{a_\phi}$. (7)

OR

12. a) State divergence theorem and explain the physical significance of divergence. (7)

 b) Derive coordinate transformation between cartesian to spherical coordinates. (7)

MODULE II

13. a) Apply Gauss's Law to find the expression for electric field intensity due to an infinite sheet of charge. (8)

b) Given the potential $V = \frac{10}{r^2}\sin\theta\, cos\varphi$. (i) Find the electric flux density D at (2, π/2,0), (ii) Calculate the work done in moving 10μC charge from point A(1,30°,120°) to B (4, 90°,60°). (6)

OR

14. a) Derive the expression for capacitance of a coaxial cable. (8)

b) Derive Poisson's and Laplace's equations for electrostatic field. (6)

MODULE III

15. a) Derive an expression for magnetic field intensity due to a straight current carrying conductor of finite length using Biot-Savart's Law. (10)

b) State and prove Ampere's circuital law. (4)

OR

16. a) Derive the boundary conditions to explain the behavior of magnetic field at the interface of two magnetic media. (10)

b) What is conduction current and displacement current? (4)

MODULE IV

17. a) Derive wave equations from Maxwell's equations for free space and write wave equations in phasor form. (10)

b) Explain phase velocity and group velocity. (4)

OR

18. a) State and prove Poynting theorem and explain its physical significance. (10)

b) Determine the depth of penetration for copper at 3 MHz. The conductivity for copper is $58 \mu℧ m^{-1}$ and permeability is $1.26\ \mu H m^{-1}$. (4)

MODULE V

19. a) At a frequency of 100MHz, the following values are appropriate for certain transmission line: L=0.25μH/m, C=80pF/m, R=0.15Ω/m and G=8μ℧/m. Determine (a) α (b) β (c) λ (d) v (e) Z_0. (8)

b) Write short note on Propagation constant and characteristic impedance. (6)

OR

20. a) Derive the wave equations for a transmission line. (10)

b) Explain impedance matching in transmission lines. (4)

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