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SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

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

Course Code : **20ECT302**

Course Name: **Electromagnetics**

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

PART A

(Answer all questions. Each question carries 3 marks)

1. State Gauss law.
2. Define the Curl of a vector field. Explain its physical significance.
3. List Maxwell's equations in integral form.
4. What is Displacement current density?
5. Define Snell's law.
6. Define skin depth for a conductive medium.
7. What is a transmission line? What are the line parameters in the transmission line?
8. Define Reflection coefficient and VSWR.
9. Explain the different modes of propagation in rectangular wave guide.
10. The cross section of a rectangular wave guide is 20 cm x 5 cm. Find 3 lowest order mode frequencies.

PART B

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

MODULE I

11. a) State and derive Gauss's law in point form. (7)

 b) Point charges 5 nC and -2 nC are located at (2,0, 4) and (-3,0, 5), respectively. (i) Determine the force on a 1nC point charge located at (1, -3, 7). (ii) Find the electric field E at (1, - 3, 7). (7)

OR

12. a) Enumerate on Poisson's and Laplace's equations with applications. (7)

 b) A current sheet, K= 10a_z A/m, lies in the x=5m plane and a second sheet, K = - 10a_z A/m, is at x = - 5 m. Find H at all points. (7)

MODULE II

13. a) Derive the expression of capacitance of a two wire transmission line. (7)
    b) State and prove boundary conditions for E and H in accordance with Maxwell's equations. (7)

OR

14. a) Derive the expressions for Energy stored in magnetic field. (7)
    b) In a lossless medium for which $\eta = 60\pi$, $\mu_r = 1$, and $H = -0.1 \cos(\omega t - z)\, a_x + 0.5 \sin(\omega t - z)\, a_y$ A/m, calculate ε_r, ω, and E. (7)

MODULE III

15. a) Derive the expression for reflection coefficient for a wave of perpendicular polarization, travelling from one medium to another at oblique incidence. (7)
    b) Given two dielectric media, the first medium is free space and the second medium has $\varepsilon_2 = 4\,\varepsilon_0$ and $\mu = \mu_0$. Find the reflection coefficient for oblique incidence at $\theta_1 = 30^0$ for (i) perpendicular polarization and ii) parallel polarization. (7)

OR

16. a) Derive the expression for Brewster angle for a parallel polarized wave. (7)
    b) What is polarization? Explain the different types of Polarizations. (7)

MODULE IV

17. a) Derive the expression for r-circles in Smith chart. (7)
    b) Derive the expression of input impedance due to a transmission line terminated by a load. Also find the expression for SWR. (7)

OR

18. a) A lossless transmission line with $Z_o = 50\Omega$ is 30m long and operates at 2 MHz. The line is terminated with a load $Z_L = 60+j40\Omega$. If u= 0.6c, where c is the velocity of light, on the line, using Smith chart find i) Reflection coefficient ii) The standing wave ratio and iii) input impedance. (7)
    b) Derive the expression for voltage and current distribution of a line terminated with load. (7)

MODULE V

19. a) Derive the expressions for Transverse Electric (TE) mode propagation in a parallel plane wave guide. (10)
    b) A rectangular waveguide has dimensions 5cm x 2.5cm. Determine the guide wavelength, and phase velocity at a wavelength of 4.5cm for dominant mode. (4)

OR

20. a) Elaborate on hollow rectangular waveguide and write its field equations. (4)

b) Derive the expressions for Transverse magnetic (TE) mode propagation in a parallel plane wave guide. (10)

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