Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree (S,FE) Examination January 2022 (2015 Scheme)

Course Code: EC303

Course Name: APPLIED ELECTROMAGNETIC THEORY

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) State and explain Gauss law. Derive the expression for electric flux density for an infinite sheet of charge. (8)

b) State and prove boundary conditions for E and H in accordance with Maxwell's equation (7)

2 a) Derive Poisson's and Laplace equation in electrostatics. (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.** (8)

3 a) 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)

b) State and explain Maxwell's equations in the integral and differential forms. (8)

PART B

Answer any two full questions, each carries 15 marks.

4 a) 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 polarisation and ii) parallel polarisation. (8)

b) Derive the expression of input impedance due to a transmission line terminated by a load .Also find the expression for SWR. (7)

5 a) Derive Poynting vector theorem. (8)

b) A transmission line of $Z_0 = 50\Omega$ is terminated by $R_L = 100\ \Omega$. Find VSWR, Z_{min} and Z_{max} (7)

6 a) What is polarisation? Explain the different types of Polarisation? (7)

b) A distortionless transmission line operating at 500MHz has $Z_o = 80\Omega$, $\alpha = 0.04$Np/m, $\beta = 1.5$rad/m. Find the line parameters R,L,G and C (8)

PART C

Answer any two full questions, each carries 20 marks.

7 a) A lossless transmission line with Z_o=50Ω is 30m long and operates at 2 MHz. The line is terminated with a load Z_L= 60+j40 Ω. If u= 0.6c on the line ,using Smith chart find: (10)

i) Reflection coefficient ii) The standing wave ratio and iii) input impedance

b) Explain the propagation of electromagnetic wave in a rectangular waveguide (10)

8 a) Explain single stub matching using analytical method. (10)

b) In a rectangular waveguide for which a=1.5cm, b=0.8cm, σ=0,μ =μ_0 and ε= ε_o (10)

$$H_x = 2\sin\frac{\pi x}{a}\cos\frac{3\pi y}{b}\sin(\pi * 10^{11}t - \beta z)A/m$$

Determine i) mode of operation ii) Cut-off frequency iii) Phase constant iv) Propagation constant v) intrinsic wave impedance

9 a) Explain Half Wave and Quarter Wave Transmission lines. (7)

b) A rectangular waveguide has dimensions 5cm x 2.5cm. Determine the guide wavelength, phase velocity and phase constant at a wavelength of 4.5cm for dominant mode. (8)

c) Explain degenerate modes. (5)

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