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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

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 (8)

Write Poisson's and Laplace's Equation with applications

b) Derive the expression for capacitance of two wire transmission line. (7)

2 a) In free space, Expression of Electric field of a plane wave is given by (7)

$\bar{E} = 50 \cos (10^8 t - \square x) \hat{a}_y$, Find

i. Direction of propagation9

ii. Intrinsic Impedance

iii. Expression of Magnetic field

iv. Attenuation constant

v. Phase constant

vi. Skin depth

b) State and explain Maxwell's equation in Integral and differential form (8)

3 a) For a plane wave propagating in a lossy dielectric, derive the expression for Propagation constant. (8)

b) Explain Scalar and vector magnetic potential (7)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Derive the expression for reflection coefficient for a wave of perpendicular polarization , travelling from one medium to another at oblique incidence . (8)

b) Explain wave polarization

Find the polarisation of the following waves (7)

i. $\bar{E} = 10 \cos(\omega t - \square x) \hat{a}_y$

ii. $\bar{E} = 16 \sin(\omega t - \square x) \hat{a}_y + 25 \cos(\omega t - \square x) \hat{a}_z$

iii. $\bar{E} = 10 \sin (\omega t - \square x) \hat{a}_y + 10 \cos (\omega t - \square x) \hat{a}_z$

iv. $\bar{E} = 20 \sin (\omega t - \square x) \hat{a}_y + 20 \sin (\omega t - \square x) \hat{a}_z$

5 a) Derive the equation of input impedance of a transmission line due to line terminated by a load . (7)

b) Derive the expression of characteristic impedance of transmission line (8)

6 a) Show that Brewster angle does not exist for a non magnetic medium for perpendicular polarization (8)

b) A lossless transmission line has a characteristic impedance of 50Ω and phase constant of 3 Rad/ m at 100 MHz . Find Inductance per meter and Capacitance per meter of the transmission line . (7)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Explain single stub matching . (10)

For a load impedance of 60 – j80Ω , design a single stub short circuit shunt tuning network to match this load to a 50Ω line using smith chart .

b) A 50 + j200 Ω load is connected to a 100Ω lossless transmission line . Using smith chart , find (10)

i. Reflection coefficient at load

ii. VSWR

iii. Load admittance

iv. Input impedance at 0.2 λ from the load

v. Reflection coefficient at 0.2 λ from the load

8 a) Explain the propagation of Electromagnetic wave in a rectangular waveguide (10)

b) Derive the expression for Electric and magnetic field intensities for TM mode of propagation of rectangular waveguide. (10)

9 a) A rectangular wave guide has a dimension of 3cm x 5cm , and is operating at a frequency of 10 GHz . Calculate the cutoff wavelength, cutoff frequency , guide wavelength , phase velocity and group velocity . and the wave impedance for TE10 mode. (10)

b) Derive expression for length and position of stub for single stub tuning method using Analytical method. (10)