

Reg No.: _____

Name: _____

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)
 $\vec{E} = 50 \cos(10^8 t - \beta x) \hat{a}_y$, Find
- i. Direction of propagation
 - 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 (8)
 Propagation constant.
- 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 (8)
 polarization, travelling from one medium to another at oblique incidence.
- b) Explain wave polarization (7)
 Find the polarisation of the following waves
- i. $\vec{E} = 10 \cos(\omega t - \beta x) \hat{a}_y$
 - ii. $\vec{E} = 16 \sin(\omega t - \beta x) \hat{a}_y + 25 \cos(\omega t - \beta x) \hat{a}_z$
 - iii. $\vec{E} = 10 \sin(\omega t - \beta x) \hat{a}_y + 10 \cos(\omega t - \beta x) \hat{a}_z$
 - iv. $\vec{E} = 20 \sin(\omega t - \beta x) \hat{a}_y + 20 \sin(\omega t - \beta x) \hat{a}_z$

- 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 $60 - j80\Omega$, design a single stub short circuit shunt tuning network to match this load to a 50Ω line using smith chart .
- b) A $50 + j200 \Omega$ load is connected to a 100Ω lossless transmission line . Using smith chart , find (10)
- Reflection coefficient at load
 - VSWR
 - Load admittance
 - Input impedance at 0.2λ from the load
 - Reflection coefficient at 0.2λ 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 $3\text{cm} \times 5\text{cm}$, 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)