

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
- Find the polarisation of the following waves (7)
- 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  $50\Omega$  and phase constant of  $3 \text{ Rad/ m}$  at  $100 \text{ MHz}$  . 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  $50\Omega$  line using smith chart .
- b) A  $50 + j200 \Omega$  load is connected to a  $100\Omega$  lossless transmission line . Using smith chart , find (10)
- i. Reflection coefficient at load
  - ii. VSWR
  - iii. Load admittance
  - iv. Input impedance at  $0.2 \lambda$  from the load
  - v. Reflection coefficient at  $0.2 \lambda$  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  $10 \text{ GHz}$  . Calculate the cutoff wavelength, cutoff frequency , guide wavelength , phase velocity and group velocity . and the wave impedance for TE<sub>10</sub> mode. (10)
- b) Derive expression for length and position of stub for single stub tuning method using Analytical method. (10)