

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017**

**Course Code: EC303**

**Course Name: APPLIED ELECTROMAGNETIC THEORY (EC)**

Max. Marks: 100

Duration: 3 Hours

*Smith Chart to be supplied on request.*

**PART A**

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

- 1 a) Derive the expressions for Energy stored in Electric Field. (8)
- b) Eight identical charges, Q each are placed on the corners of a cube of side 'a'. Find the resultant force on a charge. (7)
- 2 a) Derive Maxwell's first and second equations from fundamental laws. (8)
- b) Starting from Maxwell equation, derive the wave equation for a conducting medium. (7)
- 3 a) Determine the inductance of a Two- wire transmission line. (5)
- b) A Parallel plate capacitor with plate area of  $5\text{cm}^2$  and a plate separation of 3mm has a voltage  $50\sin 10^3 t$  Volt applied to its plates. Calculate the displacement current assuming  $\epsilon = 2\epsilon_0$ . (4)
- c) Derive the boundary conditions for electric field at the interface of two dielectrics. (6)

**PART B**

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

- 4 a) State Poynting theorem. Derive the equation of complex vector. (8)
- b) A lossless  $50\text{-}\Omega$  transmission line is terminated in a load with  $Z_L = (50 + j25)\ \Omega$ . Calculate (i) The reflection coefficient  $\Gamma$ . (ii) The standing-wave ratio. (7)
- 5 a) Derive the input impedance of a transmission line. For a shorted section of 75 ohm transmission line,  $l = \lambda/4$ , Find the input impedance assuming  $\alpha = 0$ . (7)
- b) Differentiate circular and elliptical polarization. (8)
- 6 a) Derive standard Transmission line equations. (6)
- b) Derive Brewster angle. A parallel-polarized plane wave is incident from air onto a dielectric medium with  $\epsilon_r = 9$  at the Brewster angle. What is the refraction angle? (9)

**PART C**

*Answer any two full questions, each carries 20 marks.*

- 7 a) A lossless transmission line with  $Z_0 = 50\Omega$  is 30m long and operates at 2MHz. The line is terminated with a load  $Z_L = 60 + j40\Omega$ . If  $u = 0.6c$  on the line, find (15)
  - i) Reflection coefficient
  - ii) Standing wave ratio
  - iii) Input impedance
- b) Discuss the attenuation of waveguides. (5)
- 8 a) Explain single stub matching in detail using analytical method. (12)
- b) Explain Group velocity and Phase velocity. When a wave of 6GHz propagates in parallel conducting plates separated by 3cm, find the  $V_p$  and  $V_g$  of the wave for dominant wave. (8)
- 9 a) Explain waveguides and its different modes of wave propagation. (10)
- b) Explain Half Wave and Quarter Wave Transmission lines. Given that  $Z_L = 30 + j40\Omega$ ,  $Z_0 = 50\Omega$ . Find the shortest length ('l') and point where stub has to be placed for a matching. (Use Smith chart) (10)

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