Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 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 Ampere's circuit law. (3)

b) Derive an expression for magnetic energy of a continuous distribution of current in a volume. (7)

c) Find the potential function and electric field intensity for the region between concentric right circular cylinders, where V=0 at r=1mm and V=100 V at r=30mm. (5)

2 a) State and derive Gauss's law in point form. (7)

b) A square loop of 4m side is placed in xy-plane with its centre at the origin and sides long the coordinates axes. If the magnetic flux density in the region is given $B = (0.28a_x - 0.3a_y + 0.4a_z)e^{-0.1t}\ Wb/m^2$. Find the induced EMF in the loop at t=10 s (8)

3 a) List all Maxwell's equations in integral form (4)

b) Derive the solution of uniform plane wave in lossy dielectric medium. (6)

c) An air filled parallel plate capacitor is with following specification, area= 2 m^2 and spacing between the plates=0.1m. If a voltage $V = 20cos10^3t$ is applied across the capacitor plates, find the magnetic field between the capacitor plates. (5)

PART B

Answer any two full questions, each carries 15 marks.

4 a) What is Snell's law? (3)

b) Derive an expression for reflection coefficient of a plane wave under oblique incidence with parallel polarization at a dielectric interface. (5)

c) Define reflection coefficient and VSWR of a transmission line and derive the relation between reflection coefficient and VSWR. (7)

5 a) Derive an expression for net outward power flow associated with an electromagnetic wave, from a surface. (10)

b) State phase velocity of a wave (5)

6 a) Draw the circuit of small section of transmission line of length Δx and label the circuit parameters (3)

b) Derive the current and voltage equation of a transmission line. (7)

c) A lossless transmission line has primary constant L= 0.01μH/m, C=100pF/m. Find the characteristic impedance of the line. (5)

PART C

Answer any two full questions, each carries 20 marks.

7 a) What are distributed elements (4)

b) Derive the expression for input impedance of a loss less transmission line (8)

c) A transmission line has primary constants R=0.1Ω/m, G=0.01/m, L=0.01μH/m and C=100pF/m. Find the characteristic impedance of the line at 2 GHz. Find the following (8)

i) Reflection coefficient at the load end when it is connected to a load impedance 10+j20Ω.

ii) The reflection coefficient at a distance of 20cm from load.

8 a) Derive the expressions for Transverse magnetic (TE) mode propagation in a parallel plane wave guide. (10)

b) A load impedance 90- j 25 is to be matched to 50Ω using single stub matching find the length and location of stub using smith chart. (10)

9 a) Derive the expressions for TE mode in a rectangular wave guide (10)

b) The longitudinal electric field for TM_{11} mode is given by $E_Z = \sin 5x \sin 8y\, e^{-j\beta z}\ V/m$ Find the cut off frequency of the mode. (7)

c) The cross section of a rectangular wave guide is 20 cm ^{x}5 cm. Find 3 lowest order mode frequencies (3)

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