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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.

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| 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 $r=1\text{mm}$ and $V=100\text{ V}$ at $r=30\text{mm}$. | (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 $B = (0.28a_x - 0.3a_y + 0.4a_z)e^{-0.1t} \text{ Wb/m}^2$. Find the induced EMF in the loop at $t=10\text{ s}$ | (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 $V = 20\cos 10^3 t$ 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.

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| 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 $L=0.01\mu\text{H/m}$, $C=100\text{pF/m}$. 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 $R=0.1\Omega/\text{m}$, $G=0.01/\text{m}$, $L=0.01\mu\text{H/m}$ and $C=100\text{pF/m}$. 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 $10+j20\Omega$.
- 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 $90-j25$ 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 \times 5 cm. Find 3 lowest order mode frequencies (3)
