Reg No.:

Name:

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIFTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EC303

Course Name: APPLIED ELECTROMAGNETIC THEORY (EC)

Max. Marks: 100

PART A

Answer any two full questions, each carries 15 marks

- 1 State and prove Ampere's law. a)
 - (9) Find the expression for magnetic field intensity at the center of a circular wire b) carrying current I in the anticlockwise direction. The radius of the circle is 'a' and the wire is in XY plane.



- Define electric field intensity. Derive the equation for electric field intensity at a 2 a) (7)distance 'r' from a point charge of Q coulombs.
 - A charge of -0.3µC is located at A (25,-30,15) in cm and a second charge of 0.5 (8)b) µC at B (-10, 8, 12). Find E at:
 - i) Origin ii) P (15,20,50) in cm.
- 3 Define curl of a vector field. a)
 - Derive the equation for curl of a vector field in Cartesian co-ordinate system. (8)b)
 - (5) (c) A vector field is given by the following equation $A = (y \cos ax)a_x + (y + e^x)a_z$. Find the curl of *A* at the origin.

PART B

Answer any two full questions, each carries 15 marks

- 4 a) Write the general wave equation for a conductive medium and explain each term. (4)
 - Define skin depth for a conductive medium? If σ denote the conductivity, Derive b) (5)the equation for skin depth for a good conductor.
 - Find the skin depth, δ at a frequency of 1.6 MHz in aluminium, where (6)c) σ =38.2MS/m and μ_r = 1. Also find the propagation constant, γ and the wave velocity v.
- Derive the equation for Electric and Magnetic field intensities for an 5 a) (9)electromagnetic wave propagating in the z-direction in a dielectric medium with parameters μ_r, ε_r . Find the following:
 - i) Attenuation constant ii) Phase velocity
 - iii) Phase constant

iv) Intrinsic impedance

В

Duration: 3 Hours

Marks (6)

(2)

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b) The electric field amplitude of a uniform plane wave propagating in the a_z (6) direction is 250V/m. If $E = E_x a_x$ and $\omega = 1$ M rad/s . Find:

i) Frequency ii) Wavelength

iii) period iv) The amplitude of H

- 6 a) Derive the equation for transmission and reflection coefficients of an (7) electromagnetic wave incident normally on the boundary between two different regions.
 - (b) A wave propagating in a medium has components E = 500 cos(10⁷t βz)a_xV/m (8) and H = 1.1cos(10⁷t βz)a_yA/m. If the wave is travelling at a velocity, v = 0.5c where 'c' denote velocity of EM wave in free space. Find:
 i) μ_r ii) ε_r iii) β iv) λ v) η

PART C

Answer any two full questions, each carries 20 marks

- 7 a) With a neat diagram explain the propagation of electromagnetic wave in a (8) rectangular wave guide?
 - b) Derive the equation for electric and magnetic field intensities for TE mode of (10) propagation.
 - c) Obtain the cut off frequency for propagation in a rectangular wave guide. (2)
- 8 a) What is characteristic impedance of a transmission line? derive the equation for (8) characteristic impedance of a lossless transmission line.
 - b) Write short notes on single stub matching and double stub matching. (8)
 - c) How a smith chart is useful in finding the stub length for impedance matching (4)
- 9 a) Derive the equation for characteristic impedance, phase velocity, propagation (12) constant of a transmission line.
 - b) At a frequency of 80 MHz, a lossless transmission line has a characteristic (8) impedance of 300Ω and a wavelength of 2.5m. Find:
 - i) L
 - ii) C
 - iii) If the line is terminated with a parallel combination of 200Ω and 5pF, determine the reflection co-efficient and the standing wave ratio.
