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 Duration: 3 Hours

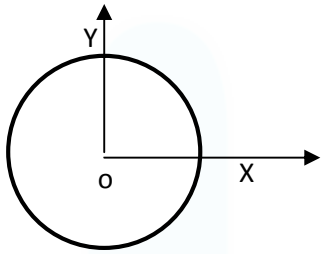
PART A

Answer any two full questions, each carries 15 marks

Marks

1 a) State and prove Ampere's law. (6)

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



2 a) Define electric field intensity. Derive the equation for electric field intensity at a distance '***r***' from a point charge of Q coulombs. (7)

b) A charge of -0.3μC is located at A (25,-30,15) in cm and a second charge of 0.5 μC at B (-10, 8, 12). Find E at: (8)

i) Origin ii) P (15,20,50) in cm.

3 a) Define curl of a vector field. (2)

b) Derive the equation for curl of a vector field in Cartesian co-ordinate system. (8)

(c) A vector field is given by the following equation $A = (y\cos ax)a_x + (y + e^x)a_z$. (5)

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)

b) Define skin depth for a conductive medium? If σ denote the conductivity, Derive the equation for skin depth for a good conductor. (5)

c) Find the skin depth, δ at a frequency of 1.6 MHz in aluminium, where σ=38.2MS/m and $\mu_r = 1$. Also find the propagation constant, γ and the wave velocity v. (6)

5 a) Derive the equation for Electric and Magnetic field intensities for an electromagnetic wave propagating in the z-direction in a dielectric medium with parameters μ_r, ε_r. Find thefollowing: (9)

i) Attenuation constant ii) Phase velocity

iii) Phase constant iv) Intrinsic impedance

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

i) Frequency ii) Wavelength

iii) period iv) The amplitude of H

6 a) Derive the equation for transmission and reflection coefficients of an electromagnetic wave incident normally on the boundary between two different regions. (7)

(b) A wave propagating in a medium has components $E = 500\cos(10^7 t - \beta z)a_x$ V/m and $H = 1.1\cos(10^7 t - \beta z)a_y$ A/m. If the wave is travelling at a velocity, $v = 0.5c$ where 'c' denote velocity of EM wave in free space. Find: (8)

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 rectangular wave guide? (8)

b) Derive the equation for electric and magnetic field intensities for TE mode of propagation. (10)

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 characteristic impedance of a lossless transmission line. (8)

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 constant of a transmission line. (12)

b) At a frequency of 80 MHz, a lossless transmission line has a characteristic impedance of 300Ω and a wavelength of 2.5m. Find: (8)

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.

****