Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S, FE) / S3 (PT) (S,FE) Examination June 2024 (2015 Scheme)

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 Coulombs law. (3)

b Derive the expression for energy density in electrostatic field (9)

c If the electric field intensity is given by E ($x\mathbf{u}_x + y\mathbf{u}_y + z\mathbf{u}_z$) volt/m. Calculate the potential difference between X (2, 0, 0) and Y (1, 2, 3). (3)

2 a Derive the boundary condition of electric field and magnetic field from Maxwell's equations. (7)

b What is Poisson's and Laplace equations? (3)

c Derive the expression for capacitance of a spherical capacitor. (5)

3 a Write Maxwell's equation in differential and integral form. (8)

b Explain the propagation of waves in good conductors. (4)

c A uniform plane wave in the free space is normally incident on an infinitely thick dielectric slab (dielectric constant $\varepsilon_r = 9$). Calculate the magnitude of reflection coefficient. (3)

PART B

Answer any two full questions, each carries 15 marks.

4 a Derive Poynting vector theorem. (10)

b Characteristic impedance of transmission line is 50Ω. Input impedance of the open circuited line is Zoc= 100 +j150Ω. When the transmission line is short-circuited, calculate the value of input impedance (5)

5 a Explain propagation of plane wave at oblique incidence for perpendicular polarisation. (8)

	b)	Find the depth of penetration for copper when an electromagnetic wave is incident normally. Given that the frequency of wave is 30MHz, $\mu_r = 1$ and conductivity = 5.8×10^7 mho/m.	(3)
	c	Derive the expression for propagation constant of a medium.	(4)
6	a	Explain distortion less transmission line.	(4)
	b	Derive transmission line equations.	(8)
	c	A transmission line has a characteristic impedance of 50Ω and a resistance of 0.1 / m. Ω. If the line is distortion less, find the attenuation constant (in Np/m)?	(3)

PART C

Answer any two full questions, each carries 20 marks.

7	a	Derive the expression for TM mode in rectangular wave guide.	(10)
	b	A rectangular waveguide of internal dimensions (a = 4cm and b = 3 cm) is to be operated in TE_{11} mode. Calculate the minimum operating frequency.	(5)
	c	What is Smith Chart? What are its applications?	(5)
8	a	Derive expression for TE mode in rectangular wave guide.	(10)
	b	A 50-Ω lossless transmission line is terminated in a load with impedance Z_L = (30− j50) Ω. The wavelength is 8 cm. Find: (a) the reflection coefficient at the load, (b) the standing-wave ratio on the line, (c) the position of the voltage maximum nearest the load, (d) the position of the current maximum nearest the load.	(6)
	c	Explain the principle of quarter wave transformer	(4)
9	a	Derive the expression for r-circles and x-circles in Smith chart	(10)
	b	A lossless transmission line of electrical length l = 0.35λ is terminated in a load impedance Z_L=(60+j30)Ω and Z_0=100 Ω. Find Γ, S, and Zin	(6)
	c	Show that TEM mode is absent in waveguide.	(4)

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