

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA VIZIANAGARAM
III B. Tech I Semester Supplementary Examinations, April/May -2025
ELECTROMAGNETIC WAVES AND TRANSMISSION LINES
 (ECE)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

		UNIT-I	
1.	a)	Explain the concept of propagation constant and its significance in transmission lines.	[7M]
	b)	Derive the condition for minimum attenuation in transmission lines.	[7M]
		(OR)	
2.	a)	Derive the expression for voltage and current along a transmission line terminated with arbitrary load.	[7M]
	b)	Explain the concept of wavelength and its relation to frequency and phase velocity.	[7M]
		UNIT-II	
3.	a)	Explain standing waves and derive the relation between standing wave ratio and reflection coefficient.	[7M]
	b)	Analyze the behavior of a quarter-wave transformer and derive input impedance.	[7M]
		(OR)	
4.	a)	How are transmission lines used for impedance matching? Explain with a suitable example.	[7M]
	b)	Explain how Smith chart is used to find the input impedance of a shorted stub.	[7M]
		UNIT-III	
5.	a)	State and apply Gauss law to derive the electric field due to an infinite line charge.	[7M]
	b)	Three point charges $Q_1 = 1 \mu\text{C}$, $Q_2 = -2 \mu\text{C}$, $Q_3 = 1.5 \mu\text{C}$ are located at (0,0), (1,0), and (0,1) meters respectively. Find the net electric field at the origin.	[7M]
		(OR)	
6.	a)	Derive the boundary conditions for electric field and electric displacement at the interface of two dielectrics.	[7M]
	b)	A spherical conductor of radius 5 cm carries a charge of 10 nC. Calculate the electric field at a point 15 cm away from the center.	[7M]
		UNIT-IV	
7.	a)	Derive an expression for the magnetic field intensity due to a circular loop of radius R carrying current I.	[7M]
	b)	State Maxwell's equations in integral form and explain their physical significance.	[7M]
		(OR)	
8.	a)	Derive the Maxwell's equations in differential form from basic laws of electromagnetism.	[7M]
	b)	The magnetic field of a wave is given by $\mathbf{H} = 3 \cos(10^9 t - \beta z) \mathbf{a}_x \text{ A/m}$. Find the wave frequency, propagation direction, and phase constant β .	[7M]
		UNIT-V	
9.	a)	Define polarization of electromagnetic waves. Explain different types with suitable examples.	[7M]
	b)	A plane wave is traveling in a conducting medium with $\epsilon = \epsilon_0$, $\mu = \mu_0$, and $\sigma = 5 \text{ S/m}$. If frequency = 1 GHz, calculate attenuation constant and phase constant.	[7M]
		(OR)	
10.	a)	Explain the phenomenon of wave propagation in good conductors and derive the expressions for attenuation and phase constants.	[7M]
	b)	Derive the wave equation for electric and magnetic fields in free space.	[7M]
