Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – October 2025

Date: 10-10-2025 **Time:** 11.45am to 01.15pm

School: SOE	**Program:** B. Tech	
Course Code : ECE3009	**Course Name:** Transmission Lines and Waveguides	
Semester: V	**Max Marks**: 50	**Weightage**: 25%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**20**	**20**	**10**	**-**	**-**

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **5Q x 2M=10M**

1	The characteristic impedance of a transmission line is the voltage-to-current ratio for a single wave travelling along an infinitely long line, which is defined by the line's physical dimensions and materials rather than length. It is an intrinsic feature, generally represented as the resistance of an infinitely long line, and is critical for reducing signal reflections by guaranteeing impedance matching between the line and its load. Could you give an expression for the characteristic impedance of a lossy transmission line?	**2 Marks**	**L1**	**CO1**
2	The reflection coefficient of a transmission line, represented by capital gamma (Γ), is the ratio of reflected voltage to incident voltage (or reflected current to incident current, with a negative sign) at a discontinuity, usually a load. It measures the quantity of signal that bounces back to the source due to an impedance mismatch between the transmission line and its load. What is the reflection coefficient when the load impedance equals the characteristic impedance?	**2 Marks**	**L1**	**CO1**
3	A distortionless transmission line preserves the shape of the transmitted signal, which means there is no frequency or phase	**2 Marks**	**L2**	**CO1**

	distortion. The phase constant (β) is linearly dependent on frequency, while the attenuation constant (α) is frequency independent. Mention the condition for a transmission line to be distortionless.			
4	A lossless short-circuited line of length λ/4 is a transmission line with no energy dissipation (lossless) that is terminated with a short circuit (zero impedance) at the load end. Its electrical length is one-quarter of the signal wavelength. What is the input impedance of a lossless short-circuited line of length λ/4?	**2 Marks**	**L2**	**CO2**
5	The relationship between reflection coefficient and SWR demonstrates that a higher reflection coefficient, indicating more reflected power due to an impedance mismatch, yields a higher SWR value, suggesting a poorer match. A perfect match ($\|\Gamma\| = 0$) results in an SWR of 1, indicating no reflection and a completely flat voltage or current across the line. What is the mathematical relation between SWR and reflection coefficient.	**2 Marks**	**L1**	**CO3**

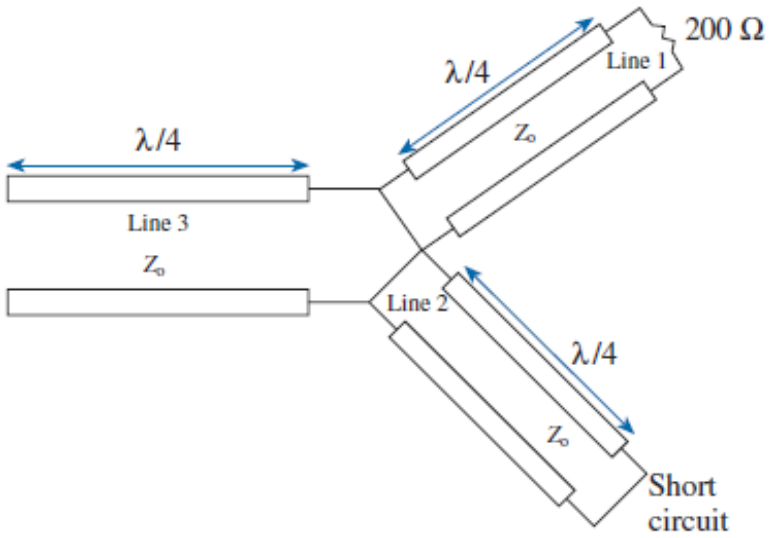
Part B

Answer the Questions. **Total Marks 40M**

6.	**a.**	Derive the expression for input impedance of a transmission line of length l terminated with a load impedance Z_L.	**10 Marks**	**L1**	**CO 1**
		Or			
7.	**a.**	A 50 Ω lossless transmission line is terminated with a load impedance of (100 + j50) Ω. (i)Calculate the reflection coefficient (magnitude and angle). (ii)Find the voltage standing wave ratio (VSWR). (iii)Determine the input impedance at a length of λ/8 from the load.	**10 Marks**	**L2**	**CO 1**

8.	**a.**	Derive the characteristic impedance of a lossy coaxial cable in terms of its primary constants	**10 Marks**	**L1**	**CO 2**
		Or			
9.	**a.**	A lossy transmission line with characteristic impedance of 75 + j60 Ω is connected to a 200 Ω load. If attenuation is 1.4 Np/m and phase constant is 2.6 rad/m, find the input impedance for l = 0.5 m.	**10 Marks**	**L2**	**CO 2**

10.	**a.**	A distortionless transmission line satisfies RC = LG. If the line has R =10 mΩ/m, C = 82 pF/m, and L = 0.6 mH/m, calculate its characteristic impedance and propagation constant. Assume that the line operates at 80 MHz.	**10 Marks**	**L2**	**CO 2**
		Or			
11.	**a.**	A 120 Ω lossless line is terminated at a load impedance (200 - j240) Ω. Find 𝛤and S.	**10 Marks**	**L2**	**CO 2**

12.	**a.**	A quarter-wave lossless 100 Ω line is terminated by a load ZL = 210 Ω. If the voltage at the receiving end is 80 V, what is the voltage at the sending end?	**10 Marks**	**L3**	**CO 3**
		Or			
13.	**a.**	**Consider the three lossless lines in Figure 1. If Zo = 50 Ω, calculate:** (a) Zin looking into line 1 (b) Zin looking into line 2 (c) Zin looking into line 3  **Figure 1**	**10 Marks**	**L3**	**CO 3**