Roll No.												

PRESIDENCY UNIVERSITY
BENGALURU

School of Engineering

Mid - Term Examinations - September 2024

Semester: 5th | **Date**: 06-11-2024

Course Code: ECE3009 | **Time**: 9:30am – 11:00am

Course Name: Transmission line and Waveguide | **Max Marks**: 50

Program: BTECH - ECE | **Weightage**: 25%

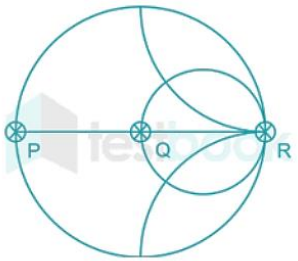
Instructions:

[1] Read all questions carefully and answer accordingly.
[2] Do not write anything on the question paper other than roll number.
[3] Scientific and non-programmable calculators are permitted.
[4] Please ask for SMITH CHART Whenever required from Invigilators.

Part A

Answer ALL the Questions. Each question carries 2marks. **2Mx5Q=10M**

1	The Smith chart is a graphical tool that makes it simple to find solutions to transmission lines related problems. Constant resistance and constant reactance circles are superimposed to create it. How can the center and radius of the constant resistance circles be found?	**2 Marks**	**L1**	**CO2**
2	In an air line adjacent maxima are found at 12.5 cm and 37.5 cm. Calculate the operating frequency.	**2 Marks**	**L1**	**CO1**
3	In the transmission line, R, L, G, and C are the primary parameters. Identify the criteria that determine if a transmission line is lossy and lossless?	**2 Marks**	**L1**	**CO1**
4	The points P, Q and R shown on the smith chart (normalized impedance chart) in the following represent what?	**2 Marks**	**L1**	**CO2**



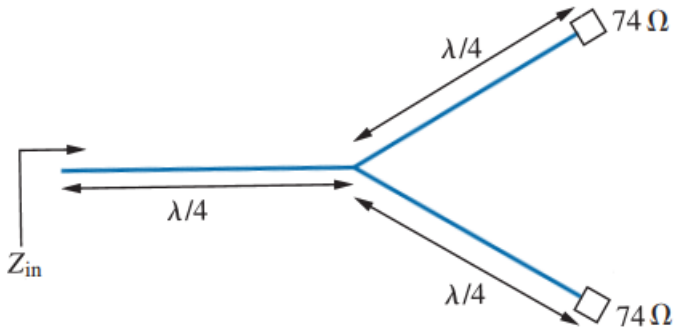
5		The conditions for a distortion less transmission line are (i) $R \neq 0, G \neq 0$ (ii)$\frac{R}{L} = \frac{G}{C}$. Write an expression for attenuation constant (α) and phase constant (β) for the distortion less transmission line?	**2 Marks**	**L1**	**CO1**

Part B

Answer ALL Questions. Each question carries 10 marks. **4QX10M=40M**

6	**6a**	The propagation constant is an essential component of transmission lines. It is a complex number that represents the behavior of an electromagnetic wave along a transmission line and is represented by the letter gamma γ, and is expressed as $\gamma = \alpha + j\beta$. The attenuation constant, represented by the letter alpha α, is the real component of the propagation constant. Along a transmission line, it results in a drop in signal amplitude. The attenuation constant is expressed in nepers/meter. The imaginary component of the propagation constant is added by the phase constant, represented by the letter beta β. It establishes the signal's sinusoidal amplitude and phase at a fixed time along a transmission line. The units of the phase constant are radians/meter. For a lossy transmission line, find the expressions for alpha and beta.	**6 Marks**	**L2**	**CO1**
	6b	Hence find the expressions for alpha and beta for the distortion-less line.	**4 Marks**	**L1**	**CO1**
		or			
7	**7a**	A graphical tool called the Smith chart makes it easy to solve issues relating to transmission lines. Construct the Smith Chart and Hence derive the expression of resistance and reactance circle. Also find the radius and center of r and x circle.	**10 Marks**	**L2**	**CO2**
8	**8a**	The Smith chart3 is the most commonly used of the graphical techniques. It is basically a graphical indication of the impedance of a transmission line and of the corresponding reflection coefficient as one moves along the line. An antenna with an impedance of (40 + j30) Ω is to be matched to a 100 V lossless line with a shorted stub. Determine using smith chart. (a) The required stub admittance (b) The distance between the stub and the antenna (c) The stub length (d) The standing wave ratio on each segment of the system	**10 Marks**	**L3**	**CO2**

or

9	**9a**	A load of (100 j150) Ω is connected to a 75 Ω lossless line. Find Using the smith chart: (a) Γ (b) VSWR (c) The load admittance YL (d) Zin at 0.4l from the load (e) The locations of Vmax and Vmin with respect to the load if the line is 0.6λ long.	**10Marks**	**L3**	**CO2**
10	**10a**	Two identical antennas, each with input impedance 74 Ω, are fed with three identical 50 Ω quarter-wave lossless transmission lines as shown in Figure. Calculate the input impedance at the source end.  	**5 Marks**	**L2**	**CO1**
	10b	A lossless transmission line is 80 cm long and operates at the frequency of 600 MHz. The line parameters are L=0.25 μH/m and C=100 pF/m. Find the characteristics of impedance, the phase constant and the phase velocity.	**5 Marks**	**L2**	**CO1**

or

11	**11a**	An airline is a transmission line where the dielectric material between the two conductors is air, which is composed of a highly conductivity substance such that R = 0 and G = 0. The phase constant of an air line with a frequency of 1 MHz is 1.5 rad/m, and its characteristic impedance is 75 ohms. For every meter in the air line, find the capacitance and inductance.	**5 Marks**	**L2**	**CO1**
	11b	A distortion-less transmission line has no frequency and delay distortion. In a distortion-less transmission line the attenuation constant and phase velocity should not depend on frequency, but the phase constant should be directly proportional to frequency. A distortion-less transmission line has a phase velocity of 0.3 times the speed of light in vacuum, a characteristic impedance of 70 ohms, and an alpha of 0.005 nepers/meter. Find R, L, G, and C at a frequency of 10 MHz.	**5 Marks**	**L2**	**CO1**

12	**12a**	The magnitude of the open-circuits and short circuit input impedance of transmission lines are 100 and 25 ohms. What is the characteristic impedance of the line?	**5 Marks**	**L2**	**CO**
	12b	A 50 V lossless line operates at 600 MHz and is terminated by a load of ZL. If the line is 0.1 m long and Zin 5 100 2 j120, find Z_L and VSWR without using Smith Chart. Assume u = 0.8 c.	**5 Marks**	**L2**	**CO1**
		or			
13	**13a**	A long power transmission line supplies 1,500 MW at 750 kV (rms) to a matched load (i.e., the load impedance equals the line impedance). (a) Suppose the load is disconnected. What is the reflection coefficient at the load? (b) Because of a fault on the line, the load changes from the matched condition to $Z_L = (200 + j100)\ \Omega$. What is the reflection coefficient at the load now?	**7 Marks**	**L2**	**CO**
	13b	For a transmission line, L=1.8mH/m C=0.01pF/m, then what is the phase constant of the line when operated at a frequency of 1 GHz.	**3 Marks**	**L2**	**CO**