Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2025

ELECTRONICS AND COMMUNICATION ENGINEERING

Semester 05

EC5401 TRANSMISSION LINES AND WAVEGUIDES

(Regulation 2019)

Time: 3 hrs | Max. Marks: 100

CO1	Ability to apply Transmission Line concepts and obtain general solution
CO2	Ability to analyze the impedance concepts
CO3	Ability to apply filter basics and design element filters
CO4	Ability to analyze the behavior of guiding structures
CO5	Ability to apply reflection and coupling concepts to coplanar wvaeguides

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

Note: Use of SMITH Chart is permitted

PART- A(10x2=20Marks)

(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Classify distortion in a transmission line and suggest suitable techniques to overcome distortion.	2	1	L2
2	Calculate the characteristic impedance of a transmission line if the following measurements have been made on the line: Z_{oc}= 550 ∟-60° Ohm and Z_{sc} = 500 ∟30° Ohm	2	1	L2
3	Design a quarter wave transformer to match a load of 200 Ω to a source resistance of 500 Ω, the operating frequency is 200 MHz	2	2	L3
4	What is a smooth line?	2	2	L1
5	Describe the behavior of reactance, α and β in passband and stopband of a filter characteristics.	2	3	L3
6	Define cut-off frequency and state the conditions for determining cut-off frequency in a lumped filter network.	2	3	L2
7	A rectangular waveguide with dimensions a = 8.5 cm and b = 4.3 cm is fed by a 5 GHz carrier. Will a TE_{11} mode be propagated?	2	4	L3
8	What are the applications of cavity resonators?	2	4	L1
9	Define Crosstalk and list the major sources for crosstalk.	2	5	L2
10	Give coupled wave equation and give its significance.	2	5	L2

PART- B (5x 13 = 65 Marks)

Q.No.	Questions	Marks	CO	BL
11 (a)	Derive the expression for the voltage and current at any point on the transmission line in terms of the propagation constant, length and characteristic impedance of the line.	13	1	L2
	OR			
11 (b)	Discuss in detail about inductance loading of a telephone cable and derive the attenuation constant, phase constant and velocity of the signal for the uniformly loaded cable.	13	1	L2

12 (a)	A load 50-j100 Ω is connected to a 50 Ω line. Design a short circuited stub to provide matching between the two at signal frequency of 30 MHz using SMITH Chart.	**13**	2	L4
	OR			
12 (b)	(i) Discuss the application of Quarter-wave line in impedance matching and copper insulators. (ii) A 30 m long lossless transmission line with characteristic impedance Z_o of 50 Ω is terminated by a load impedance Z_L of 60 + j40 Ω. The operating wavelength is 90 m. Find the reflection coefficient, Standing Wave Ratio and input impedance using SMITH chart.	**7+6**	2	L4
13 (a)	(i) Describe the attenuation and propagation characteristics of a Constant K High Pass Filter and also obtain the design equations. (ii) Design a Constant K high pass filter to attenuate all frequencies below 1000 cycles and operate with 50 Ohm characteristics impedance.	**10+3**	3	L4
	OR			
13 (b)	Derive the design equations for a Constant K band pass filter and also prove that the resonant frequency is the geometric mean of the upper and lower cut-off frequency.	**13**	3	L4
14 (a)	(i) Derive the expressions for the field components of TM waves between parallel plates propagating in the 'z' direction. (ii) A pair of perfectly conducting planes are separated by 8 cm in air. For a frequency of 500 MHz with TM_1 mode excited, find phase shift, phase velocity and group velocity.	**10+3**	4	L3
	OR			
14 (b)	(i) Obtain the solution of Electric and Magnetic fields of TE waves guided along rectangular wave guide with necessary field configurations. (ii) Calculate the resonant frequency of an air filled rectangular waveguide of dimensions a = 3 cm and b = 2 cm operating in TE_{11} mode.	**10+3**	4	L3
15 (a)	Write detailed notes on the following passive transmission lines. (i) Strip line (ii) Coplanar Waveguide	**6+7**	5	L2
	OR			
15 (b)	(i) Discuss the various crosstalk minimization techniques adopted in High Speed Transmission lines. (ii) With a neat diagram, explain the concept of measuring the characteristic impedance of a transmission line using TDR.	**6+7**	5	L2

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	A filter on the input to a telephone line is to attenuate all frequencies above 1500 c, with particularly large attenuation at 2000 c. The input resistance of the telephone line is 550 Ohms. Design and draw the resultant circuit diagram, assuming a reasonably constant Z0 is desired.	**15**	3	L4