



SCHOOL OF ELECTRONICS ENGINEERING

CAT – I, Fall Semester 2024-25

Course Code : BECE305L

Slot : E2+TE2

Course Name : Antenna and Microwave Engineering

Max. Marks : 50

General instruction(s): Answer ALL Questions

Q.No	Question	Marks
1.	The S-parameter matrix of a 3-port network is given below: $S = \begin{bmatrix} 0.178\angle 90^\circ & 0.6\angle 45^\circ & 0.4\angle 45^\circ \\ 0.6\angle 45^\circ & 0 & 0.3\angle -45^\circ \\ 0.4\angle 45^\circ & 0.3\angle -45^\circ & 0 \end{bmatrix}$ Check the following S-parameter properties: (i) Is this network reciprocal? (ii) Is this network lossless? (iii) Find the Return loss at port 1. (iv) Insertion loss between port-1 and port-2. (v) Calculate the power delivered to port-3 if the input power at port-1 is 10 Watt.	10
2.	a) A lossless circulator (clockwise) has insertion loss of 1 dB, an isolation of 30 dB, find the S-matrix. b) Consider a three-port waveguide Tee, where the wave splits equal in magnitude and phase. In that device, a 10 GHz signal of 50 mW is fed into the matched side arm. (i) identify the component (ii) calculate the power delivered to Port 1 and 2, if the reflection coefficient is 0.1 and 0.2 at Port 1 and 2 respectively. (iii) calculate the reflection coefficient at the side arm.	3+7
3.	a) Design a 6 dB Branch-line coupler for the system impedance of 40 Ω and center frequency of 4 GHz. Draw the microstrip layout of the coupler. b) What are the advantages of Wilkinson's power divider over resistive and T-junction power dividers?	7 3
4.	Design a low-pass filter with open-circuited shunt stubs to meet the following filter design specifications: 0.5 dB ripple characteristics in pass band, cutoff frequency of 3 GHz, third order, impedance 75 Ω. The normalized element coefficients are: $g_1=1.5963$, $g_2=1.0967$ $g_3=1.5963$. Draw the typical layout of the final filter circuit.	10
5.	Design a stepped-impedance low-pass filter having a maximally flat response of order 7 and cutoff frequency of 5 GHz. The filter impedance is 50 Ω; the highest practical line impedance is 120 Ω, and the lowest is 20 Ω. The normalized filter coefficients are: $g_1=0.7677$, $g_2=0.3744$, $g_3=0.2944$, $g_4=0.2378$, $g_5=0.1778$, $g_6=0.1104$, $g_7=0.0375$. Draw the final schematic of the filter.	10