International Islamic University Chittagong (IIUC)

Department of Electronic and Telecommunication Engineering

Final Examination

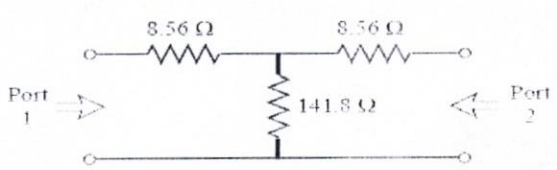
Program: **B.sc (Engg.)**
Course Code:**ETE–4741**
Total Marks: **50**

Semester: **Spring 2023**
Course Title:**Microwave Engineering**
Time:**2 Hours 30 Minutes**

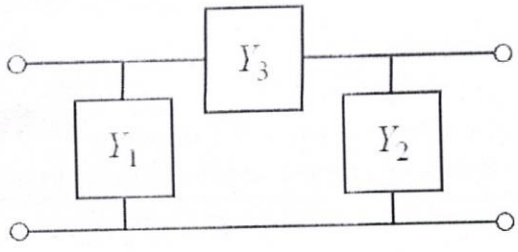
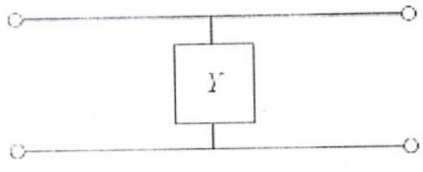
(i) Answer all the questions. The figures in the right-hand margin indicate full marks.
(ii) Course Outcomes (COs) and Bloom's Levels are mentioned in additional Columns.

Course Outcomes (COs) of the Questions	
CLO1	Understand the working principle of different Microwave Components
CLO2	Analyze Microwave Circuits and Components using suitable engineering analytical techniques
CLO3	Design different Microwave Components satisfying specified criteria.

Bloom's Levels of the Questions						
Letter Symbols	R	U	Ap	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

		PART A			
Q1.	a)	Explain how the Dominant mode of a Rectangular Waveguide Cavity is different from the dominant mode of a Rectangular Waveguide of same dimension.	CLO1	U	3
	b)	Show that, $Z_{in} = R + 2L\Delta\omega$ for series resonant circuits.	CLO2	An	4
	c)	Show that, a open circuited 0.5λ transmission line behaves like a parallel resonator circuit.	CLO3	E	3
Q2.	a)	Explain what does S_{ij} correspond to in case of Scattering Matrix where i and j correspond to row and column numbers of Scattering Matrix respectively.	CLO2	U	2
	b)	A four-port network has the scattering matrix shown as follows. (a) Is this network lossless? (b) Is this network reciprocal? (c) What is the return loss at port 1 when all other ports are terminated with matched loads? $[S] = \begin{bmatrix} 0.2\angle 50^\circ & 0 & 0 & 0.4\angle -45^\circ \\ 0 & 0.6\angle 45^\circ & 0.7\angle -45^\circ & 0 \\ 0 & 0.7\angle -45^\circ & 0.6\angle 45^\circ & 0 \\ 0.4\angle -45^\circ & 0 & 0 & 0.5\angle 45^\circ \end{bmatrix}$ Fig.1	CLO2	An	4
	c)	Find the scattering parameters of the 3 dB attenuator circuit shown in Figure 2.  Fig. 2	CLO2	An	4

OR

Q2.	a)	Point out when microwave devices are considered to be reciprocal, lossless and matched at all ports?	CLO2	U	3
	b)	Derive ABCD Matrix for Fig. 3  Fig. 3	CLO2	An	4
	c)	Derive ABCD Matrix for Fig. 4  Fig. 4	CLO2	An	4

PART B

Q3.	a)	Briefly explain the operation of a Isolator with proper figure.	CLO1	U	4
	b)	Derive S Parameter for Magic Tee.	CLO2	E	6

OR

Q3.	a)	Briefly explain the operation of a Rat Race Junction with proper figure	CLO1	U	4
	b)	Summarize the properties of a directional coupler. Explain Coupling Factor, Directivity, Isolation and Insertion loss of a directional coupler.	CLO1	U	4
	c)	Point out tasks of the following components in a Microwave Network, preferably in a single sentence: (CO1) I. Attenuator II. Phase Shifter	CLO1	U	2
Q4.	a)	Differentiate between Velocity and Current modulation. Explain how each occurs in Klystron Amplifier.	CLO1	U	5
	b)	Why is TWT called a slow wave structure? Explain the operation of TWT briefly.	CLO1	U	2+3
Q5.	a)	Write the full form of "IMPATT". Explain the operation of IMPATT Diode briefly.	CLO1	U	4
	b)	Explain how PIN diode can be used as variable resistor in high frequency applications.	CLO1	U	3
	c)	Why is Gunn Diode called Transferred Electron Device (TED)? Explain.	CLO1	U	3