

# International Islamic University Chittagong (IIUC)

## Department of Electronic and Telecommunication Engineering

### Final Examination

Program: **B.sc (Engg.)**  
 Course Code: **ETE-4741/4721**  
 Total Marks: **50**

Semester: **Spring 2022**  
 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						
<b>CLO1</b>	Understand the working principle of different Microwave Components					
<b>CLO2</b>	Analyze Microwave Circuits and Components using suitable engineering analytical techniques					
<b>CLO3</b>	Design different Microwave Components satisfying specified criteria					
Bloom's Levels of the Questions						
Letter Symbols	R	U	Ap	An	E	C
<b>Meaning</b>	Remember	Understand	Apply	Analyze	Evaluate	Create

#### PART A

- Q1.** a) Show that, a short circuited  $0.25\lambda$  transmission line equivalent to Parallel Resonator. **CLO3 C 4**
- b) Explain the relationship between Q Factor and Bandwidth. **CLO1 U 2**
- c) Show that,  $Z_{in} = R + 2L\Delta\omega$  for series resonant circuits. **CLO2 E 4**
- Q2.** a) Why do we need Equivalent Voltage and Current for analysis of TE and TM mode but not for TEM Mode? What are the conditions to be taken into account for determining equivalent voltage and current for TE and TM modes. **CLO2 U 5**
- b) Determine the Z parameters of the two-port T-network shown in Fig. 1 **CLO2 An 5**

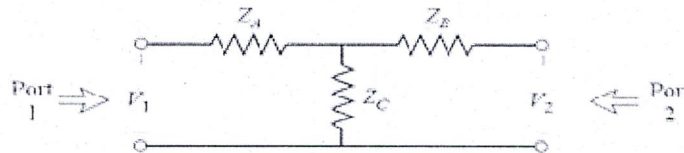


Fig.1

**OR**

- 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) Point out when microwave devices are considered to be reciprocal, lossless and matched at all ports? **CLO2 U 3**

c) Derive ABCD Matrix for Fig. 2

CLO2 An 5

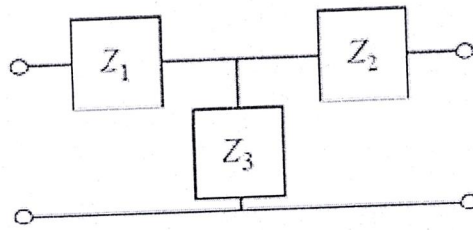


Fig. 2

**PART B**

- |           |  |               |    |     |
|-----------|--|---------------|----|-----|
| Q3.       | a) Briefly explain the operation of a Rat Race Junction with proper figure   | CLO1          | U  | 4   |
|           | b) Differentiate between E plane Tee and H Plane Tee. Derive S parameter of a H plane Tee  | CLO1,<br>CLO2 | An | 1+5 |
| Q4.       | a) Summarize the properties of a directional coupler. Explain Coupling Factor, Directivity, Isolation and Insertion loss of a directional coupler.   | CLO1          | U  | 4   |
|           | b) Briefly explain the operation of a Microwave Isolator   | CLO1          | U  | 4   |
|           | c) Point out tasks of the following components in a Microwave Network, preferably in a single sentence: (CO1)  | CLO1          | U  | 2   |
|           | I. Attenuator  |               |    |     |
|           | II. Phase Shifter  |               |    |     |
| Q5.       | a) Differentiate between Velocity and Current modulation. Explain how each occurs in Klystron Amplifier.   | CLO1          | U  | 5   |
|           | b) With the aid of a schematic diagram, describe the travelling wave tube. Why does the TWT need such a slow-wave structure? What is the purpose of strapping in a magnetron?                | CLO1          | U  | 2+3 |
| <b>OR</b> |  |               |    |     |
| Q5.       | a) Using energy band diagrams, explain the Tunnel Diode V-I Characteristic point by point. Take it for granted that quantum mechanical tunneling will take place under favourable condition. | CLO1          | U  | 5   |
|           | b) Explain the effect of Intrinsic Layer on Capacitance of PIN Diode. (CO1)  | CLO1          | U  | 2   |
|           | c) Why is Gunn Diode called Transferred Electron Device (TED)? Explain.  | CLO1          | U  | 3   |