

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

CLASS: BTECH
BRANCH: ECE

SEMESTER : VII
SESSION : MO/2025

SUBJECT: EC401 MICROWAVE THEORY AND TECHNIQUES

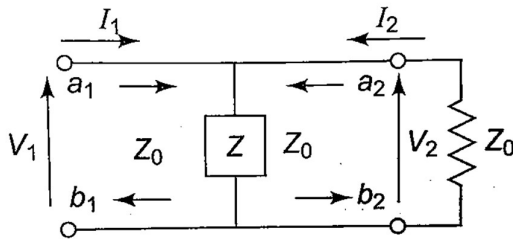
TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

- | | CO | BL |
|---|------------|-----|
| Q.1(a) For an N-port Network, derive an expression to evaluate the power at N th port, in terms of normalized input and reflected wave peak amplitude at N th port.
For any Two port Network derive an expression to present Parameter 'A' of ABCD matrix in terms of its equivalent Z matrix parameters. | [3+2]
1 | 2,3 |
| Q.1(b) Prove that a reciprocal microwave device has the same characteristics in either direction of a pair of ports and characterized by a symmetric scattering matrix.
A Shunt Impedance Z is connected across a transmission line with characteristic impedance Z ₀ as shown below. Find the S-Matrix if the junction | [3+2]
1 | 2,3 |



- | | | |
|---|------------|-----|
| Q.2(a) Explain construction and working of Magic Tee. Design a four-port circulator using 2 Magic Tee. | [3+2]
2 | 1,3 |
| Q.2(b) Explain the working of basic forward wave directional coupler. Design a center hole Bethe hole directional coupler with air-filled rectangular waveguide of dimension 0.9in X 0.4 in at 9.8 GHz for 20dB coupling and 40 dB directivity respectively. | [3+2]
2 | 1,3 |
| Q.3(a) Explain construction and working of Travelling wave tube. What is velocity modulation. Discuss the significance of Applegate diagram. | [3+2]
3 | 1,2 |
| Q.3(b) Compare 'O type' and 'M type' linear beam microwave tube structure. Discuss the construction and working of Magnetron. | [3+2]
3 | 1,2 |
| Q.4(a) Compare the characteristics of LF, HPF, BPF and BSF. Draw respective equivalent low pass circuit for all of them. | [3+2]
4 | 1 |
| Q.4(b) Explain how the standing wave is generated in Microwave devices. Design a microstrip low pass filter with cutoff frequency 2 GHz, 30 dB attenuation at frequency 3.5 GHz for Chebyshev attenuation response with 0.2 dB ripple. Use alumina substrate of thickness 0.63mm. | [3+2]
4 | 1,3 |
| Q.5(a) Discuss the properties of ferrites and Fraday rotation in ferrite. Explain working of a ferrite phase shifter. | [3+2]
5 | 1 |
| Q.5(b) Discuss construction and working of a ferrite circulator, compare it with ferrite isolator. | [3+2]
5 | 1,3 |