

MICROWAVE ENGINEERING-I

Time: 3 Hours Min. Passing Marks: 24 Maximum Marks: 80

Instruction to Candidates:

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit-I

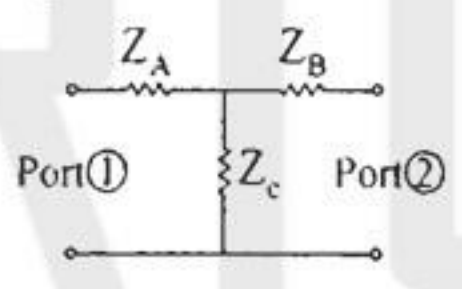
- Derive expressions for the fields in rectangular waveguide in case of Transverse Magnetic (TM) wave. [8]
 - Draw the field lines for:
 - TE₁₀ mode
 - TM₁₁ mode
 - TE₂₀ mode
 - TM₂₁ mode in a rectangular waveguide. [8]

OR

- Explain the following terms with respect to microstrip transmission lines:
 - Effective dielectric constant.
 - Characteristic impedance.
 - Losses in microstrip lines.
 - Electric & magnetic field lines. [8]
 - Find the characteristics impedance of microstrip line that is fabricated on dielectric substrate having $\epsilon_r = 3.2$, $w = 1.78\text{mm}$, $h = 0.762\text{mm}$ and operating frequency is 5 GHz. [8]

Unit-II

- Find the z-parameter of the two-part T-network shown in figure: [8]



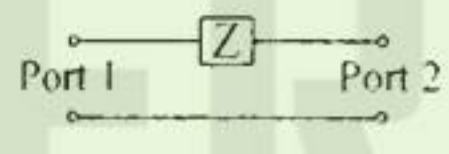
- A certain two-port network is measured and the following scattering matrix is obtained:

$$[S] = \begin{bmatrix} 0.1 \angle 0 & 0.8 \angle 90^\circ \\ 0.8 \angle 90^\circ & 0.2 \angle 0 \end{bmatrix}$$

From this data, determine whether the network is reciprocal or lossless. [8]

OR

- Does a nonreciprocal lossless network always have a purely imaginary impedance matrix? [8]
 - Find the S-parameter for the series load shown below. Assume a characteristic impedance z_0 .



Unit-III

- Write s-matrix and explain the working of magic tees. [8]
 - Draw the directional coupler and explain return loss, directivity, coupling and isolation. [8]

OR

- Design a 3dB branch line coupler. Draw its layout using microstrip line. [8]
 - Draw the Wilkinson power divider and its layout using microstrip line. [8]

Unit-IV

- Describe the microwave power measurement. [8]
 - Calculate the VSWR when the distance between half power points is 1mm . Assume the wave is in dominant mode and given that the dimension of the guide are $4 \times 2.5\text{ cm}$ and frequency is 10 GHz. [8]

OR

- Explain the measurement using network analyzer. [8]
 - What is low VSWR? Describe its measurement. [8]

Unit-V

- List the basic materials for MMICs. [8]
 - Describe the MMIC techniques. [8]

OR

- Describe the discrete, integrated, and monolithic microwave integrality circuits. [8]
 - Discuss the capacitor - film development. [8]