

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**ME - SEMESTER- II(Old course) • EXAMINATION (Remedial) – WINTER- 2015**

**Subject Code: 1724101****Date: 09/12/2015****Subject Name: RF and Microwave Circuits****Time: 2:30 pm to 5:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) A load of  $100 + j150 \, \Omega$  is connected to a  $75 \, \Omega$  lossless line. Find the reflection coefficient, the standing wave ratio  $s$ , the load admittance  $Y_L$ ,  $Z_{in}$  at  $0.4\lambda$  from the load, the location of  $V_{max}$  and  $V_{min}$  with respect to the load if the line is  $0.6\lambda$  long,  $Z_{in}$  at the generator using Smith Chart. **07**
- (b) Derive all necessary field equations for TE mode in a rectangular waveguide. **07**
- Q.2** (a) A rectangular waveguide with dimensions  $a = 2.5 \, \text{cm}$ ,  $b = 1 \, \text{cm}$  is to operate below  $15.1 \, \text{GHz}$ . How many TE and TM modes can the waveguide transmit if the guide is filled with a medium characterized by  $\epsilon_r = 4$ ,  $\mu_r = 1$ ? Calculate the cutoff frequencies of the modes. **07**
- (b) What do you mean by impedance matching? Explain stub matching method used in transmission line. **07**

**OR**

- (b) Derive all necessary field equations for TE modes in a circular waveguide. **07**
- Q.3** (a) A certain two-port network is measured and the following scattering matrix is obtained. From following data, determine whether the network is reciprocal or lossless. If a short-circuit is placed on port 2, what will be the resulting return loss at port 1?  
 $S_{11} = 0.1$ ,  $S_{12} = j0.8$ ,  $S_{21} = j0.8$ ,  $S_{22} = 0.2$  **07**
- (b) Derive the expression for  $Z_{in}$  for the terminated two-port network shown in Figure 1 using signal flow graphs and the decomposition rule. **07**

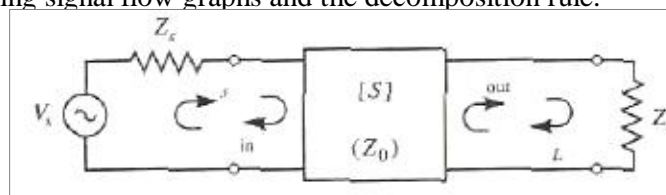


Figure 1 A terminated two-port network

**OR**

- Q.3** (a) Explain in detail the T-junction power divider using the scattering matrix. **07**
- (b) Derive the equation of quality factor  $Q$  for short-circuited  $\lambda/4$  transmission line resonator. **07**
- Q.4** (a) Explain analysis of infinite periodic structure. **07**
- (b) Explain in detail the image parameter method for filter design. **07**
- OR**
- Q.4** (a) Explain in detail the insertion loss method for filter design. **07**
- (b) Explain the Richard's transformation and Kuroda's identities with respect to filter implementation. **07**
- Q.5** (a) Explain the monolithic microwave integrated circuits. **07**

(b) Explain fully a balanced mixer in detail. **07**

**OR**

**Q.5** (a) Explain in detail ferrite isolator. **07**

(b) Define: TEM Waves, Reflection Coefficient, Return Loss, Insertion Loss, Standing Wave Ratio, Phase Velocity, and Group Velocity. **07**

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