# RAMCO INSTITUTE OF TECHNOLOGY

**Department of Electronics and Communication Engineering**

**Academic Year: 2017 - 2018 (Odd Semester)**

## Innovative Practices Description

**Degree, Semester& Branch:** VII Semester B.E. ECE A
**Course Code & Title:** EC6701 RF and Microwave Engineering
**Name of the Faculty member:** Mrs.V.SrirengaNachiyar
**Name of the Topic: Z,Y,h & ABCD parameter**
**Name of the Innovative Practice:** Online quiz

**Description:**

A two-port network (a kind of four-terminal network or quadripole) is an electrical network (circuit) or device with two pairs of terminals to connect to external circuits. Two terminals constitute a port if the currents applied to them satisfy the essential requirement known as the port condition: the electric current entering one terminal must equal the current emerging from the other terminal on the same port.

### Impedance parameters (z-parameters)

$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} z_{11} & z_{12} \\ z_{21} & z_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

where

$$z_{11} \stackrel{\text{def}}{=} \left.\frac{V_1}{I_1}\right|_{I_2=0} \qquad z_{12} \stackrel{\text{def}}{=} \left.\frac{V_1}{I_2}\right|_{I_1=0}$$

$$z_{21} \stackrel{\text{def}}{=} \left.\frac{V_2}{I_1}\right|_{I_2=0} \qquad z_{22} \stackrel{\text{def}}{=} \left.\frac{V_2}{I_2}\right|_{I_1=0}$$

### Admittance parameters (y-parameters)

$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

where

$$y_{11} \stackrel{\text{def}}{=} \left.\frac{I_1}{V_1}\right|_{V_2=0} \qquad y_{12} \stackrel{\text{def}}{=} \left.\frac{I_1}{V_2}\right|_{V_1=0}$$

$$y_{21} \stackrel{\text{def}}{=} \left.\frac{I_2}{V_1}\right|_{V_2=0} \qquad y_{22} \stackrel{\text{def}}{=} \left.\frac{I_2}{V_2}\right|_{V_1=0}$$

### Hybrid parameters (h-parameters)

$$\begin{bmatrix} V_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ V_2 \end{bmatrix}$$

where

$$h_{11} \stackrel{\text{def}}{=} \left.\frac{V_1}{I_1}\right|_{V_2=0} \qquad h_{12} \stackrel{\text{def}}{=} \left.\frac{V_1}{V_2}\right|_{I_1=0}$$

$$h_{21} \stackrel{\text{def}}{=} \left.\frac{I_2}{I_1}\right|_{V_2=0} \qquad h_{22} \stackrel{\text{def}}{=} \left.\frac{I_2}{V_2}\right|_{I_1=0}$$

### *ABCD*-parameters

$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_2 \\ -I_2 \end{bmatrix}$$

where

$$A \stackrel{\text{def}}{=} \left.\frac{V_1}{V_2}\right|_{I_2=0} \qquad B \stackrel{\text{def}}{=} -\left.\frac{V_1}{I_2}\right|_{V_2=0}$$

$$C \stackrel{\text{def}}{=} \left.\frac{I_1}{V_2}\right|_{I_2=0} \qquad D \stackrel{\text{def}}{=} -\left.\frac{I_1}{I_2}\right|_{V_2=0}$$

**References:**


1. https://en.wikipedia.org/wiki/Two-port_network#Impedance_parameters_(z-parameters)
2. Annapurna Das and Sisir K Das, "Microwave Engineering"
3. Reinhold Ludwig and Gene Bogdanov, "RF Circuit Design: Theory and Applications