Dr. Mahalingam College of Engineering & Technology
Pollachi – 642 003
(An Autonomous Institution affiliated to Anna University)

16EET44
Networks and Signals
Tutorial Book

Name : ----------
--

Roll No : ----------

Department & Section : ----------
--

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

Index

Tutorial No	Date	Tutorial Topic	Marks	Sign
CO1:				
1		**Network Functions**		
2		**Z Parameters**		
3		**Y Parameters**		
4		**h and g Parameters**		
5		**ABCD Parameters**		
6		**Transformation of Parameters**		
7		**Lattice and Ladder Network**		
Average				

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

RUBRICS TO BE FOLLOWED FOR TUTORIAL

Criteria	Excellent	Good	Need Improvement	Attempting	Not Attempting
	5 Points	4 Points	3 Points	2 Points	1 Point
Mathematical Calculations	90-100% steps and solutions have without mathematical errors	Almost 80 - 89% steps and solutions without mathematical errors	Most 70 - 79% steps and solutions without mathematical errors	50% steps and s mathematical calculations having errors	More steps are missing and many mathematical errors
Circuit Diagram	Circuit diagram with correct polarity are very clear and greatly add to the understanding procedures	Circuit diagram with correct polarity is clear and easy to understand	Circuit diagram with correct polarity is clear and somewhat difficult to understand	Circuit diagram with correct polarity is partially clear and difficult to understand	Circuit diagram with correct polarity is missing
Neatness	The work is presented in a clear and organized manner	The work is presented in a clear manner to understand	The work is presented in a clear	The work is presented in a clear but difficult to read	The work is un organized and appears sloppy
Completion	All problems are completed	80% problems are completed	70% problems are completed	Only 50% problems are completed	Several Problems are not completed.

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

Unit 1

NETWORK FUNCTIONS OF ONE PORT NETWORK

1.Driving Point Impedance Z:

$Z(s) = V(s)/I(s)\ \Omega$

2. Driving Point Admittance Y:

$Y(s) = 1/Z(s) = I(s)/V(s)$

Network Functions for two port networks:

1.Driving Point Impedance Z:

$Z_{11}(s) = V_1(s)/I_1(s)$

$Z_{22}(s) = V_2(s)/I_2(s)$

2. Driving Point Admittance Y:

$Y_{11}(s) = 1/Z_{11}(s) = I_1(s)/V_1(s)$

$Y_{22}(s) = 1/Z_{22}(s) = I_2(s)/V_2(s)$

3. Voltage Transfer Ratio:

$G_{12}(s)=V_1(s)/V_2(s)$

$G_{21}(s)=V_2(s)/V_1(s)$

4. Current Transfer Ratio:

$\alpha_{12}(s)=I_1(s)/I_2(s)$

$\alpha_{21}(s)=I_2(s)/I_1(s)$

5. Transfer Impedance:

$Z_{12}(s) = V_1(s)/I_2(s)$

$Z_{21}(s) = V_2(s)/I_1(s)$

6. Transfer Admittance:

$Y_{12}(s) = I_1(s)/V_2(s)$

$Y_{21}(s) = I_2(s)/V_1(s)$

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

NETWORK PARAMETERS

7. Z Parameters:

$V_1 = Z_{11} I_1 + Z_{12} I_2$

$V_2 = Z_{21} I_1 + Z_{22} I_2$

[V] = [Z] [I]

$Z_{11} = \frac{V1}{I1}$ at $I_2 = 0$ Open circuit Input Impedance

$Z_{12} = \frac{V1}{I2}$ at $I_1 = 0$ Open circuit Reverse Transfer Impedance

$Z_{21} = \frac{V2}{I1}$ at $I_2 = 0$ Open circuit Forward Transfer Impedance

$Z_{22} = \frac{V2}{I2}$ at $I_1 = 0$ Open circuit Output Impedance

8. Y Parameters:

$I_1 = Y_{11} V_1 + Y_{12} V_2$

$I_2 = Y_{21} V_1 + Y_{22} V_2$

[I] = [Y] [V]

$Y_{11} = \frac{I1}{V1}$ at $V_2 = 0$ Short circuit Input Admittance

$Y_{12} = \frac{I1}{V2}$ at $V_1 = 0$ Short circuit Reverse Transfer Admittance

$Y_{21} = \frac{I2}{V1}$ at $V_2 = 0$ Short circuit Forward Transfer Admittance

$Y_{22} = \frac{I2}{V2}$ at $V_1 = 0$ Short circuit Output Admittance

9. Hybrid Parameters(h):

$V_1 = h_{11} I_1 + h_{12} V_2$

$I_2 = h_{21} I_1 + h_{22} V_2$

$h_{11} = \frac{V1}{I1}$ at $V_2 = 0$ Short circuit Input Impedance ($\frac{1}{Y11}$)

$h_{12} = \frac{V1}{V2}$ at $I_1 = 0$ Open circuit Reverse Voltage Gain ($\frac{Z12}{Z22}$)

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

$h_{21} = \frac{I2}{I1}$ at $V_2 = 0$ Short circuit Forward Current gain ($\frac{Y21}{Y11}$)

$h_{22} = \frac{I2}{V2}$ at $I_1 = 0$ Open circuit Output Admittance ($\frac{1}{Z22}$)

10. Inverse Hybrid Parameters(g):

$I_1 = g_{11} V_1 + g_{12} I_2$

$V_2 = g_{21} V_1 + g_{22} I_2$

$g_{11} = \frac{I1}{V1}$ at $I_2 = 0$ Open circuit Input Admittance ($\frac{1}{Z11}$)

$g_{12} = \frac{I1}{I2}$ at $V_1 = 0$ Short circuit Reverse Current Gain

$g_{21} = \frac{V2}{V1}$ at $I_2 = 0$ Open circuit Voltage gain

$g_{22} = \frac{V2}{I2}$ at $V_1 = 0$ Short circuit Output Impedance ($\frac{1}{Y22}$)

11. Transmission Parameters (ABCD):

$V_1 = A_{11} V_2 - B_{12} I_2$

$I_1 = C_{21} V_2 - D_{22} I_2$

$A = \frac{V1}{V2}$ at $I_2 = 0$ $\frac{1}{A}$ is called open circuit voltage gain

$C = \frac{I1}{V2}$ at $I_2 = 0$ $\frac{1}{C}$ is called open circuit transfer impedance

$-B = \frac{V1}{I2}$ at $V_2=0$ $-\frac{1}{B}$ is called short circuit transfer admittance

$-D = \frac{I1}{I2}$ at $V_2=0$ $-\frac{1}{D}$ is called short circuit current gain

12. Inverse Transmission Parameters(A'B'C'D'):

$A' = \frac{V2}{V1}$ at $I_1 = 0$

$C' = \frac{I2}{V1}$ at $I_1 = 0$

$B' = \frac{-V2}{I1}$ at $V_2=0$

$D' = \frac{-I2}{I1}$ at $V_1=0$

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

INTER RELATIONSHIP OF DIFFERENT PARAMETERS

	Z	Y	$ABCD$	$A'B'C'D'$	h	g
Z	$Z_{11}\ Z_{12}$ $Z_{21}\ Z_{22}$	$\frac{Y_{22}}{\Delta_y}\ \frac{-Y_{12}}{\Delta_y}$ $\frac{-Y_{21}}{\Delta_y}\ \frac{Y_{11}}{\Delta_y}$	$\frac{A}{C}\ \frac{\Delta_T}{C}$ $\frac{1}{C}\ \frac{D}{C}$	$\frac{D'}{C'}\ \frac{1}{C'}$ $\frac{\Delta_{T'}}{C'}\ \frac{A'}{C'}$	$\frac{\Delta_h}{h_{22}}\ \frac{h_{12}}{h_{22}}$ $\frac{-h_{21}}{h_{22}}\ \frac{1}{h_{22}}$	$\frac{1}{g_{11}}\ \frac{-g_{12}}{g_{11}}$ $\frac{g_{21}}{g_{11}}\ \frac{\Delta_g}{g_{11}}$
Y	$\frac{Z_{22}}{\Delta_z}\ \frac{-Z_{12}}{\Delta_z}$ $\frac{-Z_{21}}{\Delta_z}\ \frac{-Z_{11}}{\Delta_z}$	$Y_{11}\ Y_{12}$ $Y_{21}\ Y_{22}$	$\frac{D}{B}\ \frac{-\Delta_T}{B}$ $\frac{-1}{B}\ \frac{A}{B}$	$\frac{A'}{B'}\ \frac{-1}{B'}$ $\frac{-\Delta_{T'}}{B'}\ \frac{D'}{B'}$	$\frac{1}{h_{11}}\ \frac{-h_{12}}{h_{11}}$ $\frac{h_{21}}{h_{11}}\ \frac{\Delta_h}{h_{11}}$	$\frac{\Delta_g}{g_{22}}\ \frac{g_{12}}{g_{22}}$ $\frac{-g_{21}}{g_{22}}\ \frac{1}{g_{22}}$
AB	$\frac{Z_{11}}{Z_{21}}\ \frac{\Delta_z}{Z_{21}}$	$\frac{-Y_{22}}{Y_{21}}\ \frac{-1}{Y_{21}}$	$A\ B$	$\frac{D'}{\Delta_{T'}}\ \frac{B'}{\Delta_{T'}}$	$\frac{\Delta_h}{h_{21}}\ \frac{h_{11}}{h_{21}}$	$\frac{1}{g_{21}}\ \frac{g_{22}}{g_{21}}$
CD	$\frac{1}{Z_{21}}\ \frac{Z_{22}}{Z_{21}}$	$\frac{\Delta Y}{Y_{21}}\ \frac{-Y_{11}}{Y_{21}}$	$C\ D$	$\frac{C'}{\Delta_{T'}}\ \frac{A'}{\Delta_{T'}}$	$\frac{-h_{22}}{h_{21}}\ \frac{-1}{h_{21}}$	$\frac{g_{11}}{g_{21}}\ \frac{\Delta_g}{g_{21}}$
$A'\ B'$	$\frac{Z_{22}}{Z_{12}}\ \frac{\Delta_z}{Z_{12}}$	$\frac{-Y_{11}}{Y_{12}}\ \frac{-1}{Y_{12}}$	$\frac{D}{\Delta_T}\ \frac{B}{\Delta_T}$	$A'\ B'$	$\frac{1}{h_{12}}\ \frac{h_{11}}{h_{12}}$	$\frac{-\Delta_g}{g_{12}}\ \frac{-g_{22}}{g_{12}}$
$C'\ D'$	$\frac{1}{Z_{12}}\ \frac{Z_{11}}{Z_{12}}$	$\frac{-\Delta_Y}{Y_{12}}\ \frac{-Y_{22}}{Y_{12}}$	$\frac{C}{\Delta_T}\ \frac{A}{\Delta_T}$	$C'\ D'$	$\frac{h_{22}}{h_{12}}\ \frac{\Delta_h}{h_{12}}$	$\frac{-g_{11}}{g_{12}}\ \frac{-1}{g_{12}}$
h	$\frac{\Delta_z}{Z_{22}}\ \frac{Z_{12}}{Z_{22}}$ $\frac{-Z_{21}}{Z_{22}}\ \frac{1}{Z_{22}}$	$\frac{1}{Y_{11}}\ \frac{-Y_{12}}{Y_{11}}$ $\frac{Y_{21}}{Y_{11}}\ \frac{\Delta_Y}{Y_{11}}$	$\frac{B}{D}\ \frac{\Delta_T}{D}$ $\frac{-1}{D}\ \frac{C}{D}$	$\frac{B'}{A'}\ \frac{1}{A'}$ $\frac{\Delta_{T'}}{A'}\ \frac{C'}{A'}$	$h_{11}\ h_{12}$ $h_{21}\ h_{22}$	$\frac{g_{22}}{\Delta_g}\ \frac{-g_{12}}{\Delta_g}$ $\frac{-g_{21}}{\Delta_g}\ \frac{g_{11}}{\Delta_g}$
g	$\frac{1}{Z_{11}}\ \frac{-Z_{12}}{Z_{11}}$ $\frac{Z_{21}}{Z_{11}}\ \frac{\Delta_z}{Z_{11}}$	$\frac{\Delta_Y}{Y_{22}}\ \frac{Y_{12}}{Y_{22}}$ $\frac{-Y_{21}}{Y_{22}}\ \frac{1}{Y_{22}}$	$\frac{C}{A}\ \frac{-\Delta_T}{A}$ $\frac{1}{A}\ \frac{B}{A}$	$\frac{C'}{D'}\ \frac{-1}{D'}$ $\frac{\Delta_{T'}}{D'}\ \frac{B'}{D'}$	$\frac{h_{22}}{\Delta_h}\ \frac{-h_{12}}{\Delta_h}$ $\frac{-h_{21}}{\Delta_h}\ \frac{h_{11}}{\Delta_h}$	$g_{11}\ g_{12}$ $g_{21}\ g_{22}$
The two port is reciprocal If	$Z_{12} = Z_{21}$	$Y_{12} = Y_{21}$	The determinant of the transmission matrix = 1 ($\Delta_T = 1$)	The determinant of the inverse transmission matrix = 1	$h_{12} = -h_{21}$	$g_{12} = -g_{21}$

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

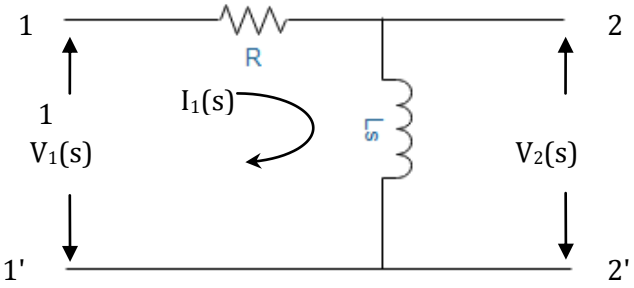
Network Functions

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

1. Find $Z_{11}(s)$, $Z_{21}(s)$ in the following circuit.

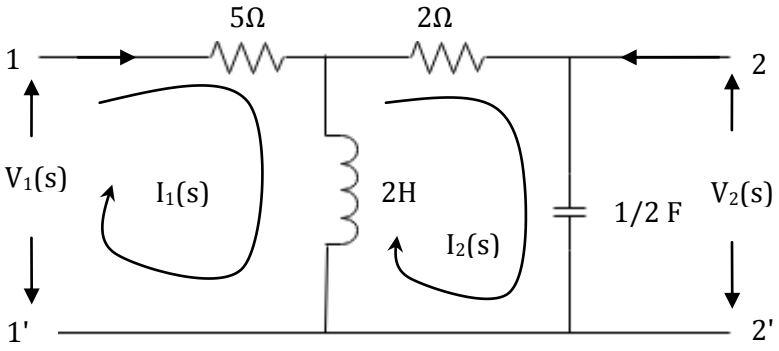


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

2.For the two port network, determine the driving point impedances $Z_{11}(s)$, the transfer impedance $Z_{21}(s)$ and the voltage transfer ratio $G_{21}(s)$.



Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

3. A function is given by $Z(s) = 2s/(S^2+16)$. Draw its pole and zero plot. and comment on stability

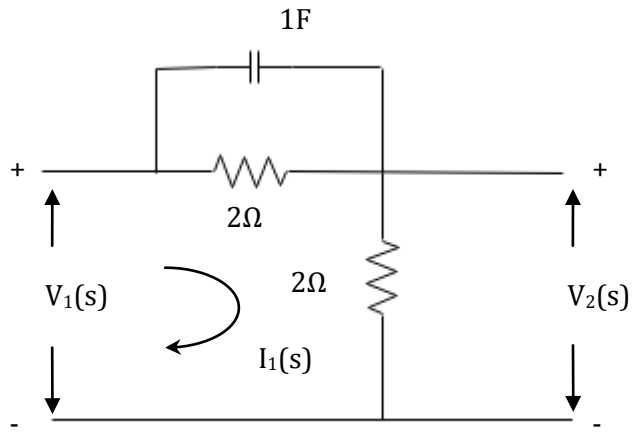
4.A network function is given by $p(s) = 2s/(s+2)(s^2+2s+2)$. Obtain the pole zero diagram and comment on stability.

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

5. For the network shown in figure obtain the transfer functions $G_{21}(s)$, $Z_{21}(s)$ and driving point impedance $Z_{11}(s)$.



Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

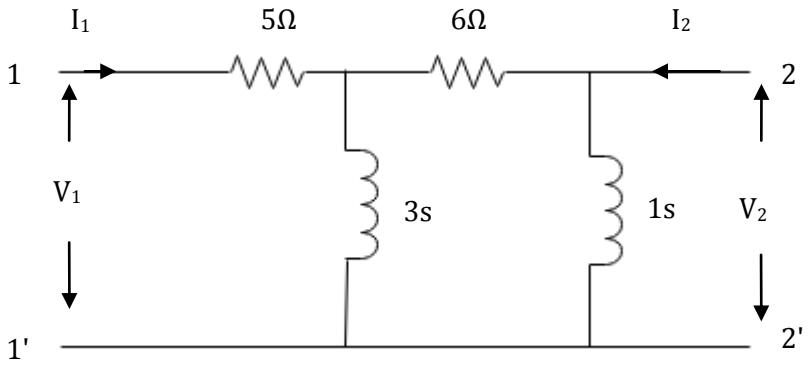
Z Parameters

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

1.Obtain Z Parameter for the following circuit.

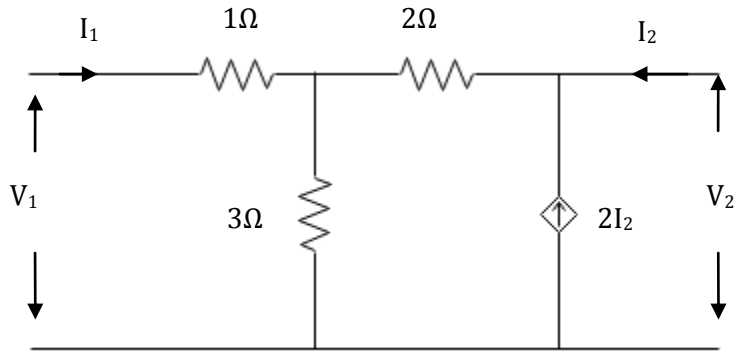


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

2.Find the Z Parameter of the network.

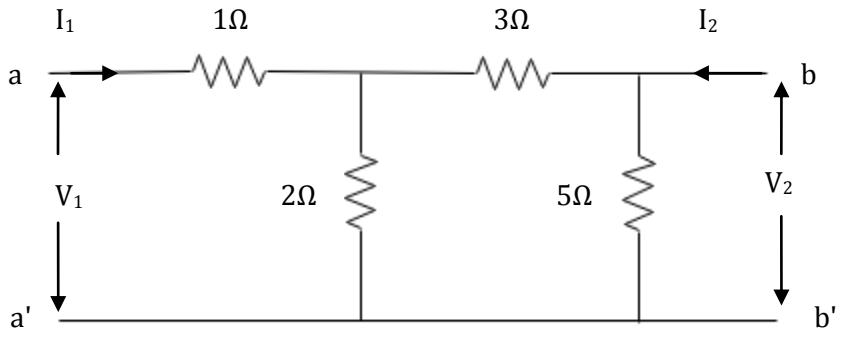


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

3. Find Z Parameter for the circuit



Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

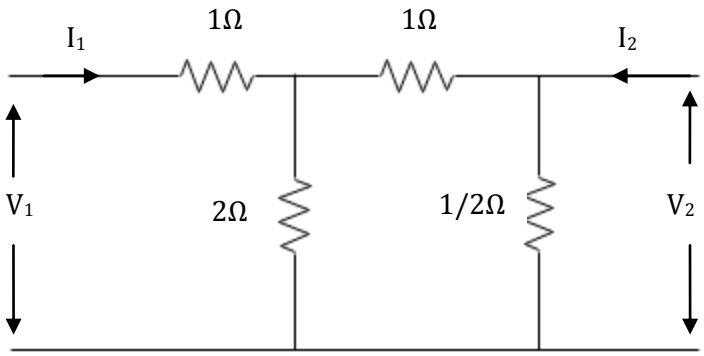
Y Parameters

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

1. Find the Y parameter for the network.

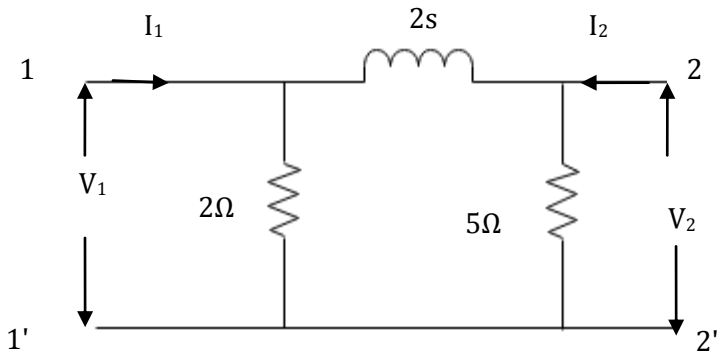


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

2. Find the Y parameter of the following circuit



Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

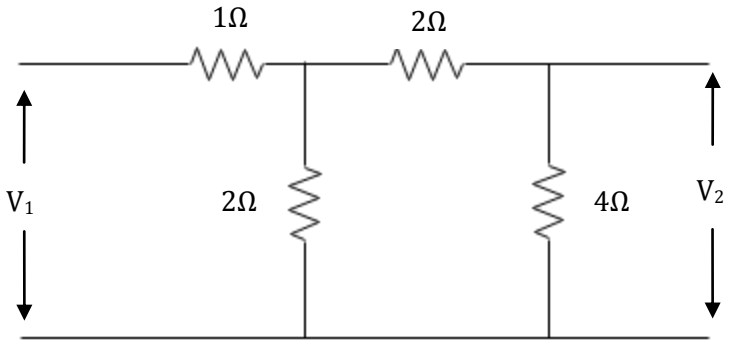
h and g Parameters

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

1. Find the h parameters of the network shown on the figure.

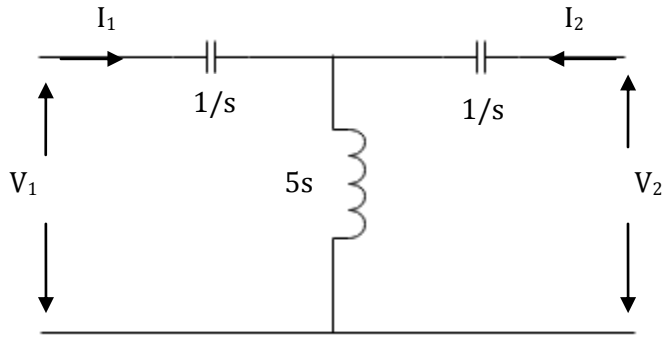


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

2. Obtain h parameters.

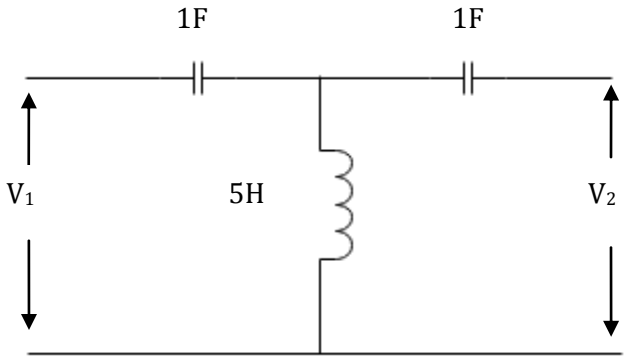


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

3. Obtain the h Parameter for the circuit shown below.

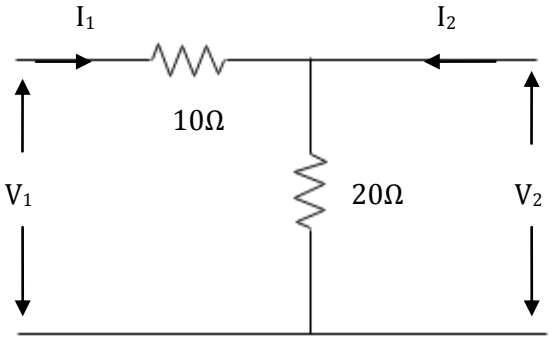


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

4. Find the g parameters of the network



Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

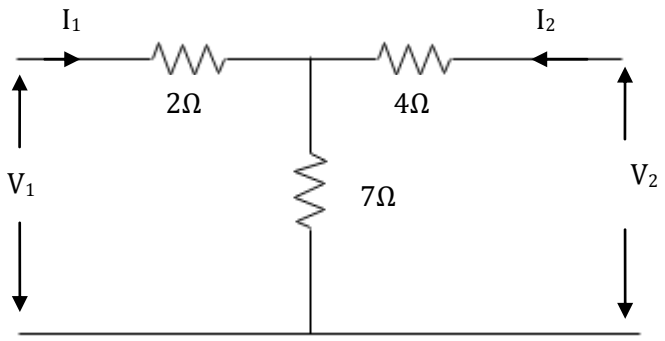
ABCD Parameters

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

1. Find the transmission Parameters.

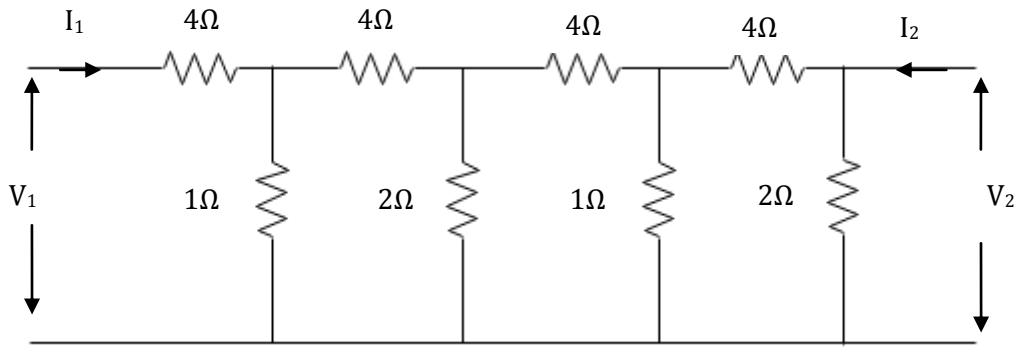


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

2. Determine the ABCD parameters of 2 network connected in cascade as shown.

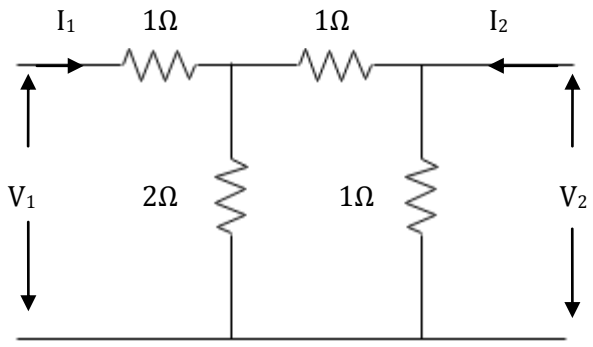


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

3. Obtain ABCD for the following problem.



Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

Transformation of Parameters

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

1. The impedance parameters of a 2 port network are Z11=2Ω, Z22=4Ω, Z21=6Ω,. Compute the h parameter and write the describing equations.

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

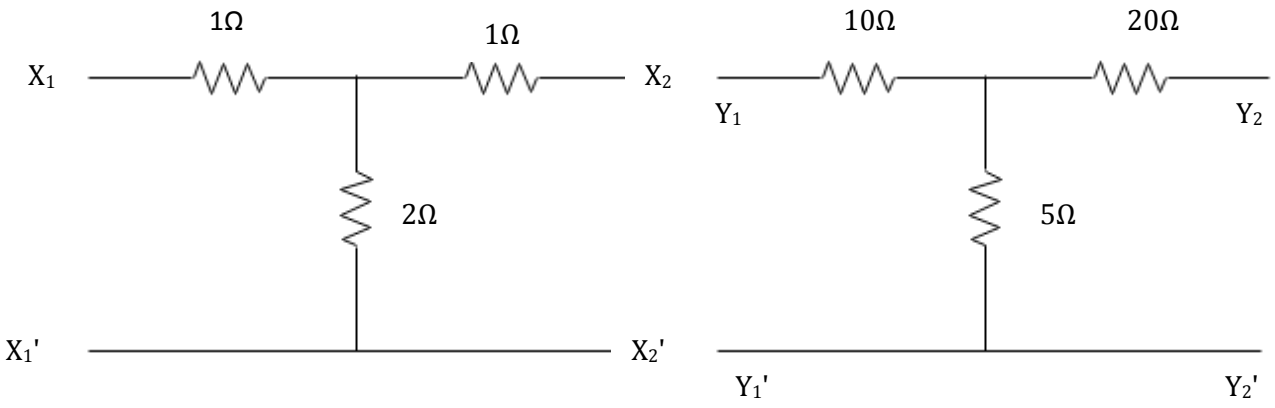
2. The impedance parameters of a 2 port network are $Z_{11}=6\Omega$, $Z_{22}=4\Omega$, $Z_{21}=3\Omega$,. Compute the Y parameter and ABCD parameters and write the describing equations.

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

3. Two networks shown in the figure are connected in series. obtain the Z parameters of the combination. Also verify by direct calculation.



Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

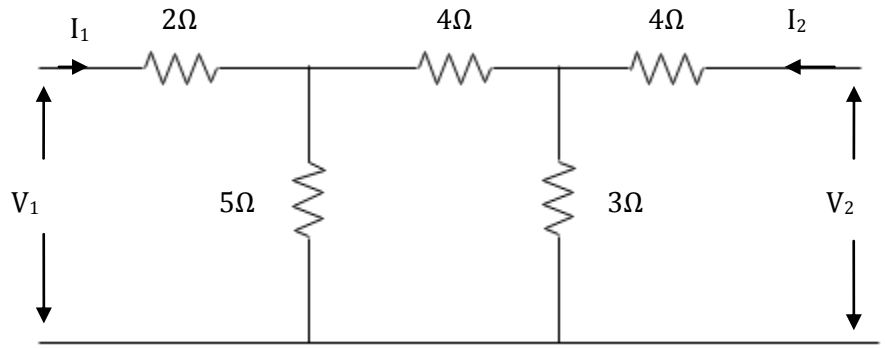
Lattice and Ladder Network

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

1. Obtain T network for the following network.

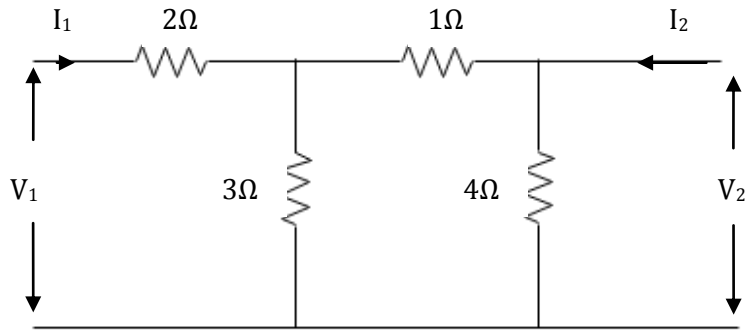


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

2. Obtain T Network for the following.

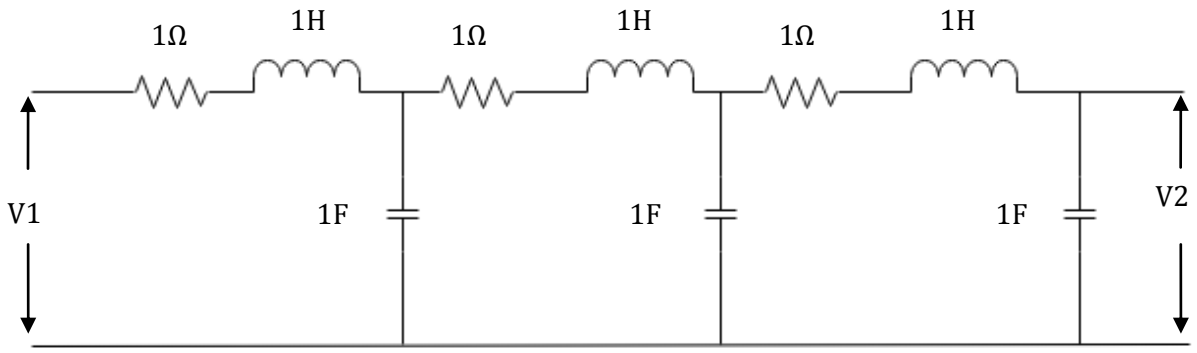


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

3. For the ladder network shown in figure obtain open circuit driving point impedance at port 1 - 2.

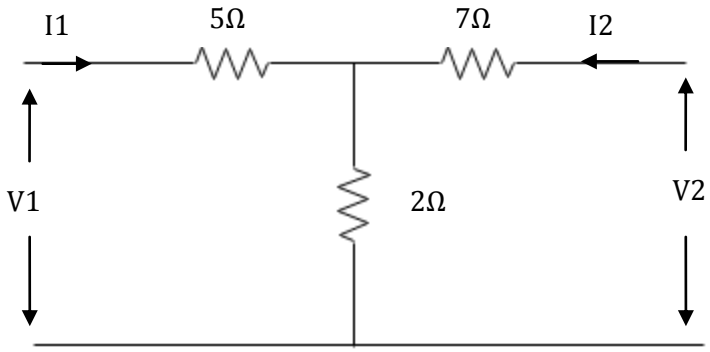


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

4. Obtain the lattice equivalent of a symmetrical T network shown on the figure below.



Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

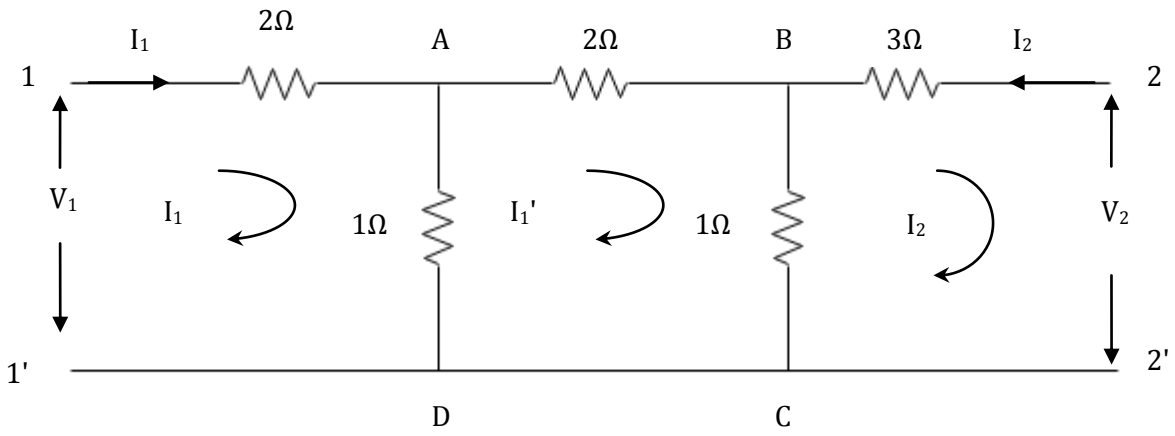
GATE QUESTIONS

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

1.The impedance parameter Z_{11} and Z_{12} of the two port network shown in figure are,

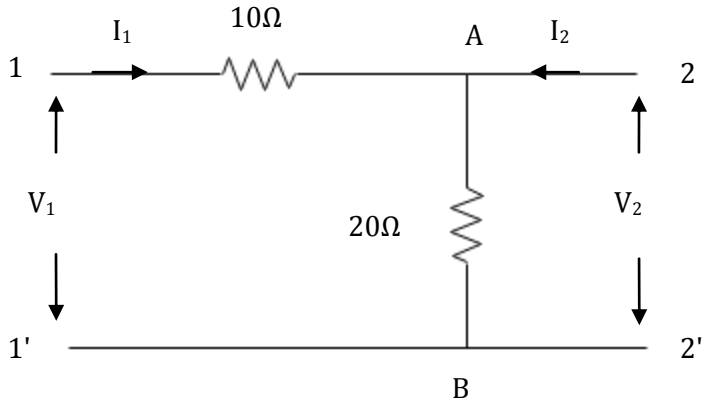


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

2.The h parameters of the circuit shown in the figure are,

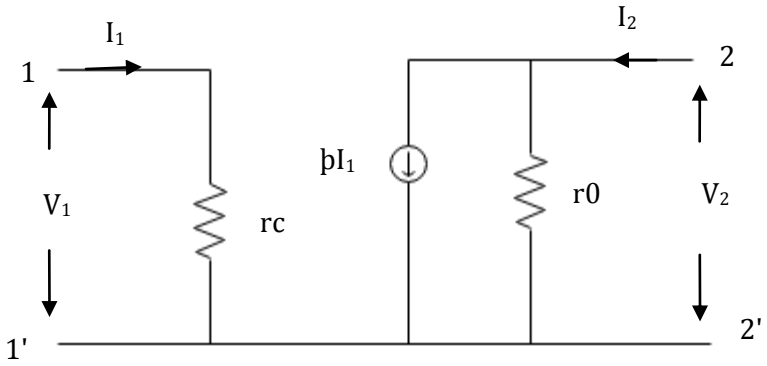


Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

3. In the two port network shown in the figure find Z_{12} and Z_{21} respectively.



Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

4.The ABCD parameters of an ideal n:1 transformer shown in the figure is $\begin{bmatrix} n & 0 \\ 0 & x \end{bmatrix}$. The value of x will be.

Dr. Mahalingam College of Engineering and Technology, Pollachi – 642003

(An Autonomous Institution affiliated to Anna University)

Course Code & Title: 16EET44 – Networks and Signals Date:

4. A two port network shown below is excited by external DC sources. two voltage and current are measured with voltmeter V_1,V_2 and ammeter A_1A_2 as indicated. Under the following condition readings obtained are.