ELEMENTS OF ELECTRICAL ENGINEERING
Course Code : UE25EE141A/B

FACULTY CONTRIBUTED:

Department of EEE, RR Campus

Prof . Jyothi T N
Prof. Vadhiraj K P P
Prof. Kruthika N
Prof. Suma S
Prof. Pushpa K R

Prof. Sangeeta Modi

Department of ECE, EC Campus

Prof. Lokesh L

Prof. Dhanashree G Bhate

Dr. Renuka R Kajur

Prof. Rajesh Chandrashekar

Prof. Sangam Kumar G H

ELEMENTS OF ELECTRICAL ENGINEERING

Thevenin's Theorem

Jyothi T N

Department of Electrical & Electronics Engineering

Usually, in a given network we are interested in the response in a particular element.

In such cases, remaining part of the network can be replaced with a simple two element series equivalent.

In power amplifier circuits, impedance matching helps in maximum power transfer to the load.

Thevenin's Theorem - Statement

It can be stated as follows:

"A linear network with a large number of independent and dependent sources and resistors between two terminals can be replaced with a simple two element series equivalent in which a voltage source called 'Thevenin's Equivalent Voltage'(V_{TH})is in series with a resistance called 'Thevenin's Equivalent Resistance' (R_{TH})."
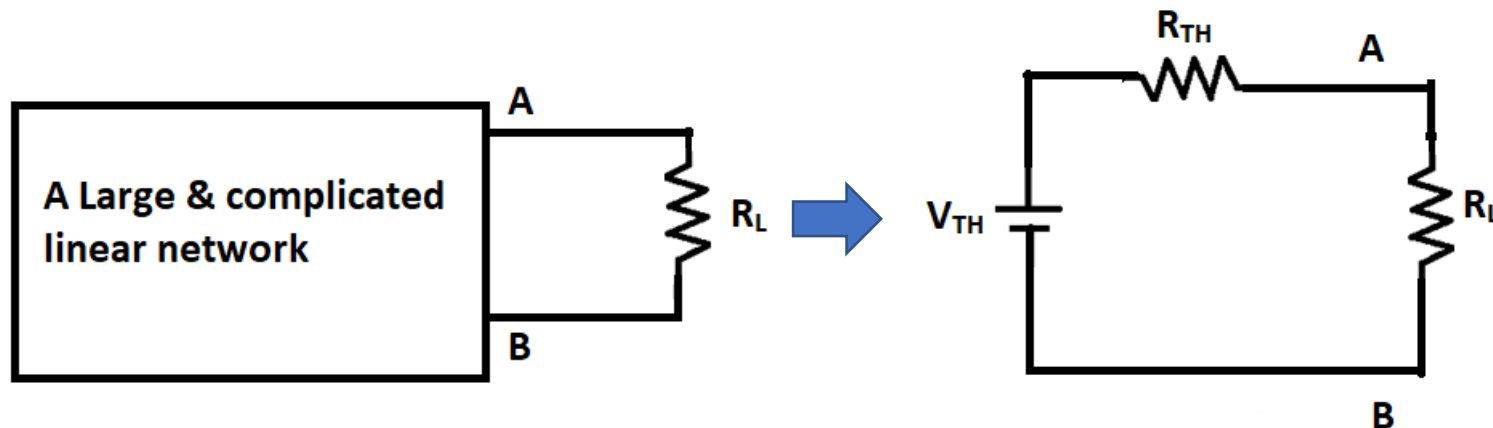
Steps to find V_{TH} :

Step 1: Remove the load resistance.

Step 2: Mark voltage across open load terminals and designate it as V_{TH}.

Step 3: Find V_{TH} using KVL or any other technique.

Steps to find R_{TH} :
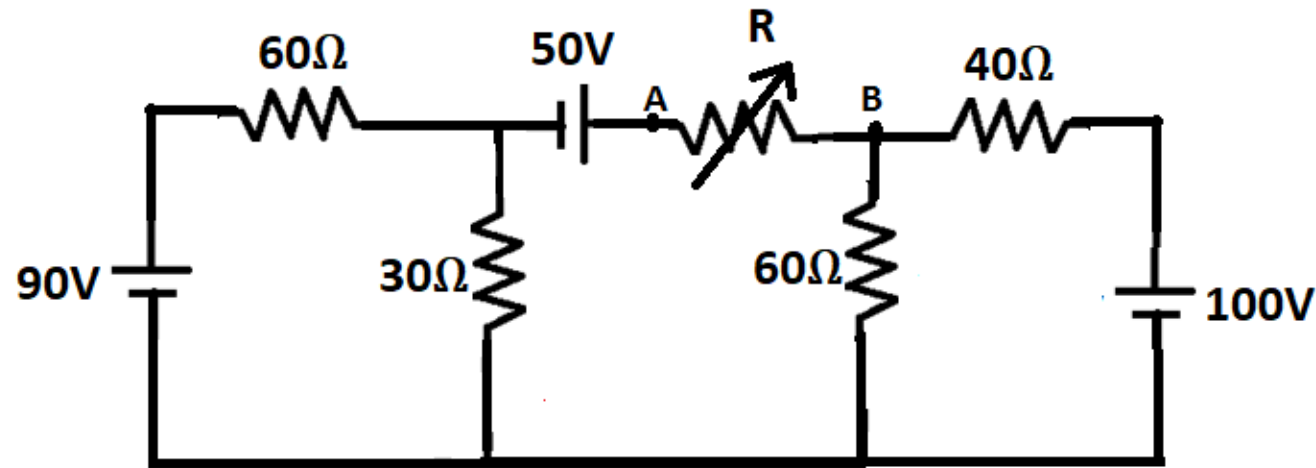
Step 1: Remove the load resistance.

Step 2: Replace all independent voltage sources with short circuit & all independent current sources with open circuit

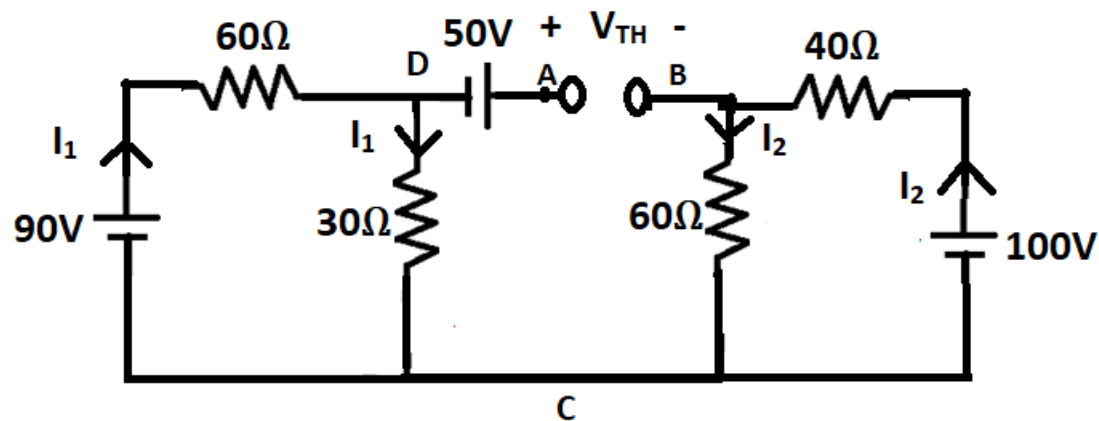Step 3: Looking into the open load terminals find the equivalent resistance.

Question:

Using Thevenin's Theorem, calculate the range of current flowing through the resistance R, as it varies from 6Ω and 36Ω.

Solution :

Finding V_{TH} :

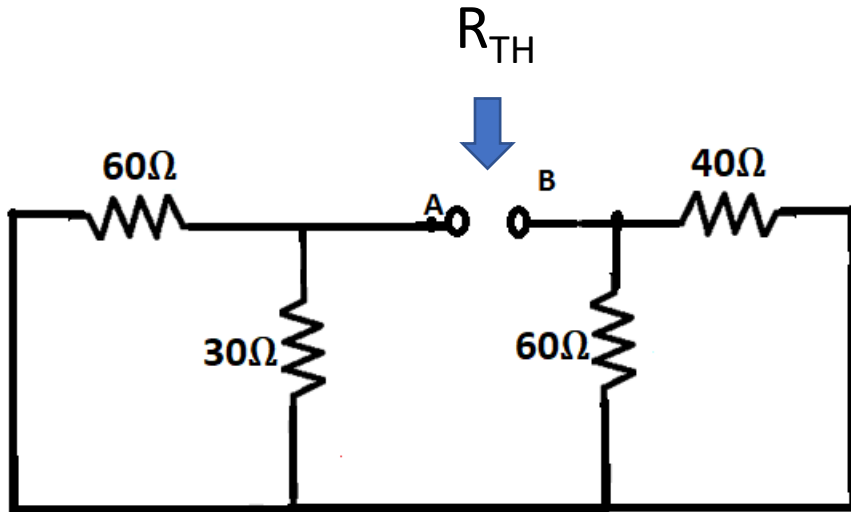$$I_1 = \frac{90V}{90\Omega} = 1A \; ; \; I_2 = \frac{100V}{100\Omega} = 1A$$

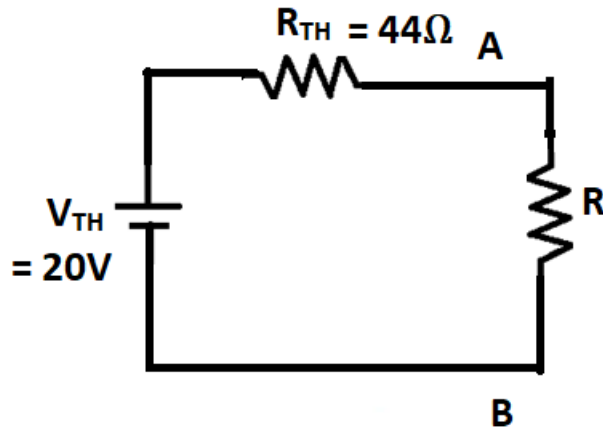By KVL (DABCD), $+50 - V_{TH} - 60*I_2 + 30*I_1 = 0$

$$V_{TH} = 20V$$

Solution (Continued..) :

Finding R_{TH} :

R_{TH} = (60Ω II 30Ω) + (60Ω II 40Ω) = 44Ω

Solution (Continued..) :

$$I_L = \frac{V_{TH}}{R_{TH}+R}$$

Circuit diagram showing $R_{TH} = 44\Omega$ at node A, $V_{TH} = 20V$ source, and resistor R between nodes A and B.

When R = 6Ω, I_L = 0.4A

When R = 36Ω, I_L = 0.25A

Hence, current through 'R' ranges from 0.25A to 0.4A

Text Book:

1. "Basic Electrical Engineering" S.K Bhattacharya, 1st Edition Pearson India Education Services Pvt. Ltd., 2017

2. "Basic Electrical Engineering", D. C. Kulshreshta, 2nd Edition, McGraw-Hill. 2019

3. "Special Electrical Machines" E G Janardanan, PHI Learning Pvt. Ltd., 2014

Reference Books:

1. "Engineering Circuit Analysis" William Hayt, Jack Kemmerly, Jamie Phillips and Steven Durbin, 10th Edition McGraw Hill, 2023

2. "Electrical and Electronic Technology" E. Hughes (Revised by J. Hiley, K. Brown & I.M Smith), 12th Edition, Pearson Education, 2016.

THANK YOU

Jyothi T N

Department of Electrical & Electronics Engineering

jyothitn@pes.edu