CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING
CHITTAGONG-4349, BANGLADESH.

Course No. EEE-182

Course Title: Basic Electrical Engineering Sessional

Experiment No. 7

VERIFICATION OF MAXIMUM POWER TRANSFER THEOREM

PRELAB WORK:

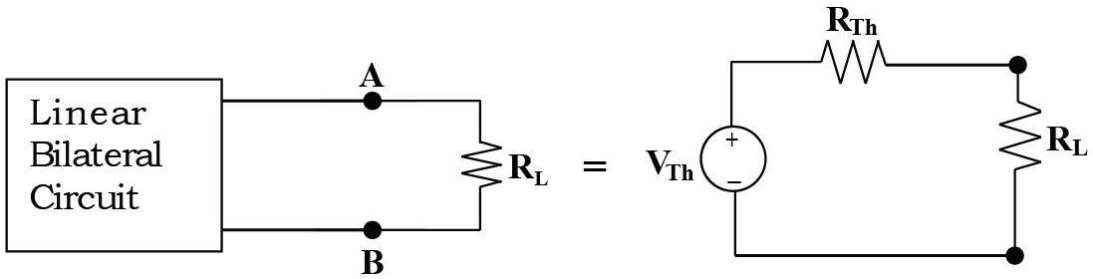
- **Read this laboratory manual carefully before coming to the laboratory class, so that you know what is required.**
- Try to **follow** the lecture notes of **EEE 111.**
- **DONOT** copy others blindly!!!
- **Submit your lab report before the roll call.**

OBJECTIVE:

The objective of this experiment is to verify maximum power transfer theorem.

THEORY:

The maximum power transfer theorem stales (hat a resistive load will receive maximum power when its total resistive value is exactly equal to the Thevenin's resistance of the network as "seen" by the load.



We know that any circuit **A** terminated with a load R_L, can be reduced to its Thevenin's equivalent. Now according to this theorem the load R_L will receive maximum power when

$$R_L = R_{Th}$$

The efficiency of power transfer is defined as the ratio of the power delivered to the load P_{out}, to the power supplied by the source P_{in}.

$$\%\eta = \frac{P_{out}}{P_{in}} \times 100 = \frac{V_L}{V_{Th}} \times 100 = \frac{R_L}{R_L + R_{Th}} \times 100$$

The voltage regulation is defined as –

$$\%VR = \frac{Load\ voltage\ at\ no\ load - Load\ voltage\ at\ full\ load}{Load\ voltage\ at\ full\ load} \times 100$$
$$= \frac{R_{Th}}{R_L} \times 100$$

At maximum power transfer condition, η = 50 % & VR= 100 %.

A relatively low efficiency of 50 % can be tolerated in situations where power levels are relatively low such as in electronic & communications circuits for transmission & reception of signal where the Engineer's goal is to receive or transmit maximum amount of power.

However, when large power levels are involved, such as at generating stations, efficiencies of 50 % would not be acceptable. The goal here is high efficiency and not maximum power. Power utility systems are designed to transmit the power to the load with the greatest efficiency by reducing the losses on the power lines. Thus the effort is concentrated on reducing R_{Th}, which would represent the resistance of the source plus the line resistance.

APPARATUS:

1. One DC voltmeter.
2. One DC Ammeter.
3. DC power supply.
4. Rheostats (R_{Th} = 22Ω, R_L = 44Ω).
5. One SPST switch.
6. Wires & Chords.

CIRCUIT DIAGRAM:

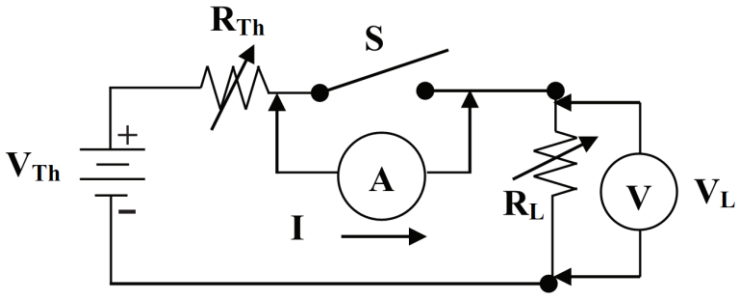


Figure: Verification of Maximum Power Transfer Theorem.

PROCEDURE:

1. Set up the circuit as shown in the above Figure.
2. Apply 30V DC from DC power supply.
3. Keep the Thevenin rheostat, R_{Th} (22Ω) at maximum position.
4. Vary the load rheostat (44Ω) from minimum to maximum value in step & measure the voltages V_L & I. Take at least 15 sets of reading.
5. Keep the Thevenin rheostat at another position & repeat step 4.

EXPERIMENTAL DATA:

No. of obs.	V_{Th} volts	V_L volts	I amps	$P_{in}= V_{Th}I$ watts	$P_{out}= V_LI$ watts	Loss = P_{in} - P_{out}	$\%\eta$	$\%VR$	$R_L=V_L/I$

REPORT:

1. Show the results in tabular form.
2. Plot the following curves on the graph paper
   a) $\%\eta$ vs R_L.
   b) %VR vs R_L.
   c) Loss vs R_L.
   d) P_{out} vs R_L.
   e) I_L vs R_L.
   f) V_L vs R_L.

CAUTION:

1. Do not switch on the supply until the circuit has been checked by your teacher.
2. Take care of the apparatus.
3. Do not touch any open ended wire or cable with applying voltage supply at the other end.

HOME TASK:

Answer the following questions –

1. Why high voltage transmission is used in case of transmitting electric power?
2. Where maximum power transfer is used?
3. Why instead of transmitting maximum power, power utility transmits power at maximum efficiency?
4. Deduce the condition for maximum power transfer.