TempleCity Institute of Technology & Engineering (TITE), Taraboi, Khurda

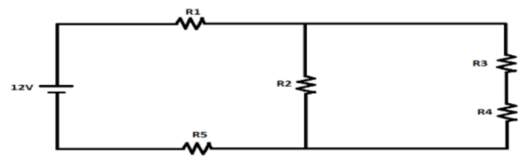
CIRCUIT AND NETWORK THEORY

Semester- 3rd (EE) **Diploma** BATCH – (2020 – 23) **Code- Th2**

Fullmark-20 **Time -1hour**

1. **Answer any three** **(3*2marks)**
   a. Unit of resistance ____ and unit of current ___.
   b. Unit of power ___and energy____.
   c. Unit of flux ___and intensity___.
   d. Current division in _____and voltage division in ____.
2. **Answer any two** **(2*3.5 marks)**
   a. Wtite the statement of ohms law.
   b. Write kirchoff's law.
   c. What is kirchoff's 2^{nd} law.
3. **Answer any one** **(1*07marks)**
   i. **Write the Statement of**
   a. Thevinins theorem.
   b. Nortons theorem.
   c.

Consider the following circuit:



What is the total equivalent resistance of the circuit?

$R1 = 5\Omega,\ R2 = 3\Omega,\ R3 = 4\Omega,\ R4 = 1\Omega,\ R5 = 2\Omega$

   ii. Define Nodal Analysis and mesh analysis.

All the best

SOLUTION NETWORK THEORY

1) a. ohm and ampere
   b. watt and joule or kilowatt hour
   c. weber and watt/square meter
   d.parallel and series

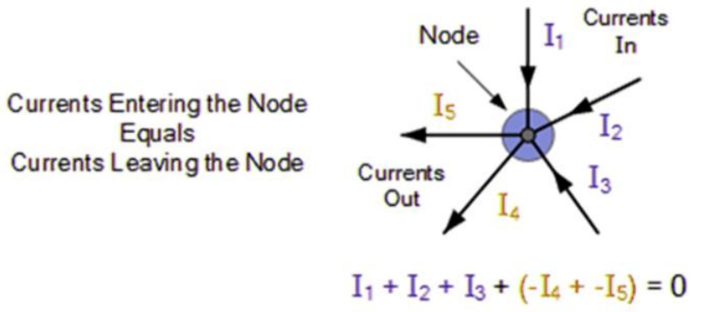
1. 2a.Ohm's Law Statement : Ohm's law states that the voltage across a conductor is directly proportional to the current flowing through it,at constant temperature.

The formula for Ohm's law is V=IR.

b. Kirchhoff's First Law or Kirchhoff's Current Law

According to Kirchhoff's Current Law,

The total current entering a junction or a node is equal to the charge leaving the node as no charge is lost.



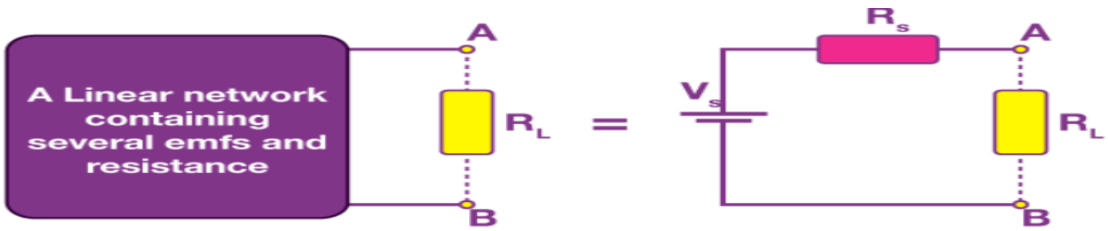
c. Kirchhoff's Second Law or Kirchhoff's Voltage Law

According to Kirchhoff's Voltage Law,

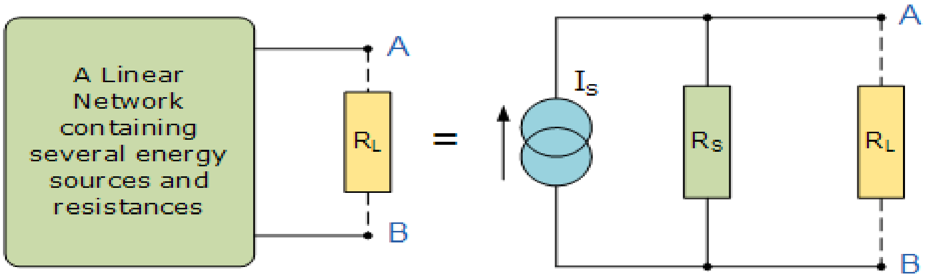
The voltage around a loop equals to the sum of every voltage drop in the same loop for any closed network and also equals to zero.

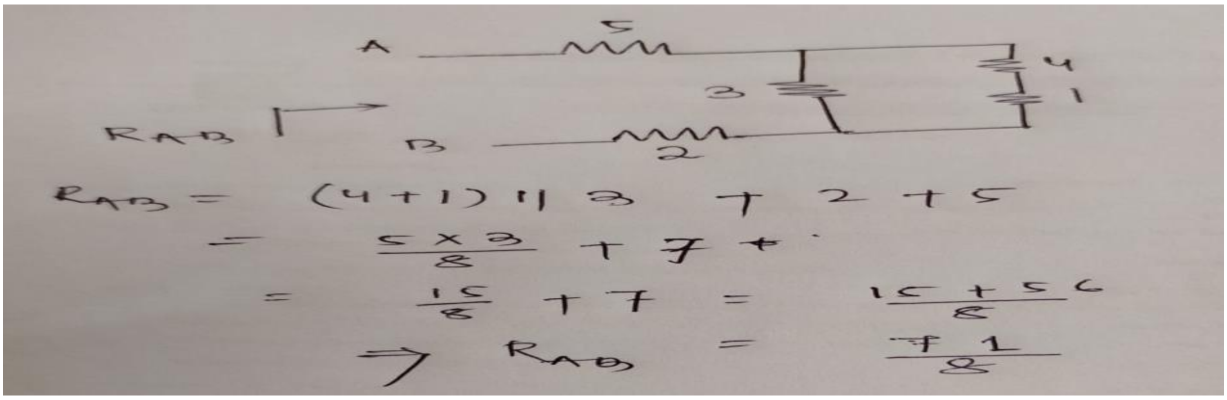
3i.

a. **Thevenin's theorem states that it is possible to simplify any linear circuit, irrespective of how complex it is, to an equivalent circuit with a single voltage source and a series resistance.**



b.Nortons Theorem states that "*Any linear circuit containing several energy sources and resistances can be replaced by a single Constant Current generator in parallel with a Single Resistor*".





ii.<u>The steps used in solving a circuit using **mesh analysis** are as follows:</u>

1. Arbitrarily assign a clockwise current to each interior closed loop in the network. Although the assigned current may be in any direction, a clockwise direction is used to make later work simpler.
2. Using the assigned loop currents, indicate the voltage polarities across all resistors in the circuit. For a resistor that is common to two loops, the polarities of the voltage drop due to each loop current should be indicated on the appropriate side of the component.
3. Applying Kirchhoff's voltage law, write the loop equations for each loop in the network. Do not forget that resistors that are common to two loops will have two voltage drops, one due to each loop.
4. Solve the resultant simultaneous linear equations.
5. Branch currents are determined by algebraically combining the loop currents that are common to the branch.

<u>The steps used in solving a circuit using **nodal analysis** are as follows:</u>

1. Arbitrarily assign a reference node within the circuit and indicate this node as *ground.* The reference node is usually located at the bottom of the circuit, although it may be located anywhere.
2. Convert each voltage source in the network to its equivalent current source. This step, although not absolutely necessary, makes further calculations easier to understand.
3. Arbitrarily assign voltages ($V_1, V_2, \ldots, V_n$) to the remaining nodes in the circuit. (Remember that you have already assigned a reference node, so these voltages will all be with respect to the chosen reference.)
4. Arbitrarily assign a current direction to each branch in which there is no current source. Using the assigned current directions, indicate the corresponding polarities of the voltage drops on all resistors.
5. With the exception of the reference node (ground), apply Kirchhoff's current law at each of the nodes. If a circuit has a total of *n* _ 1 nodes (including the reference node), there will be *n* simultaneous linear equations.
6. Rewrite each of the arbitrarily assigned currents in terms of the potential difference across a known resistance.
7. Solve the resulting simultaneous linear equations for the voltages ($V_1, V_2, \ldots, V_n$).