EE 101H – Electric Circuits

Somanath Majhi

EE101H **Electric Circuits** **3(Lect)-0(T)-0(Lab)-3(C)**

Evaluation

1.Attendance = 10 marks

2. Quiz = 30 marks

3. Mid-semester Exam = 60 marks

Pass marks to be decided by the instructor

Regularly visit the course webpage:

https://www.iitg.ac.in/smajhi

for information related to the course

Syllabus

DC Analysis: Dependent and independent Voltage and current sources, Nodes, Paths, Loops and Branches, Nodal and Mesh Analysis, Superposition, Source Transformations, Thevenin's and Norton's Theorems, Maximum Power Transfer. RL, RC and RLC Circuit.

AC Circuit Analysis: Sinusoidal Forcing Function, Phasor Relationship for R, L and C, Impedance and Admittance, Phasor Diagrams. Instantaneous Power, Average Power, Complex Power, Apparent Power and Power Factor.

Texts/References:

[1] W. H. Hayt, J. E. Kemmerly, and S. M. Durbin, *Engineering Circuit Analysis*, 8th edition. McGraw-Hill, 2013.

[2] R. J. Smith and R. C. Dorf, *Circuits, Devices and Systems,* 5th edition. John Wiley India, 2007.

[3] V. D. Toro, *Electrical Engineering Fundamentals,* 2nd edition. PHI, 2014.

[4] C.K Alexander and M.N.O. Sadiku, *Fundamentals of Electric Circuits*, 6th Edn., MGH, 2017.

Welcome to Lecture 1

INDEPENDENT, DEPENDENT VOLTAGE & CURRENT SOURCES,

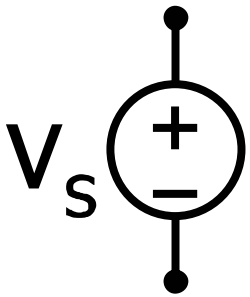
NODES, PATHS, LOOPS & BRANCHES,

KCL, KVL,

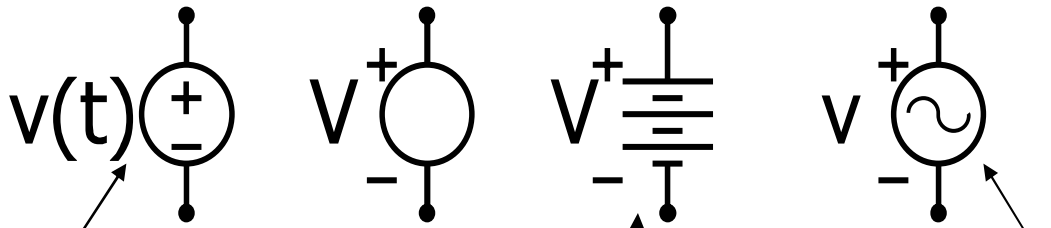
NODAL & MESH ANALYSIS

Sources

- Independent voltage source
- The terminal voltage across this element is specified (independent of the current through the element)
- Circuit symbol below:



Independent voltage source symbols



General voltage source

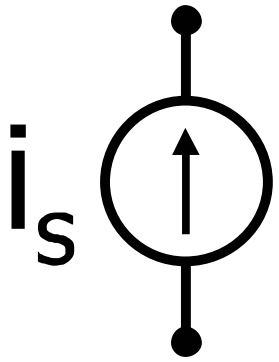
DC voltage source

Battery symbol can be used for DC voltage source

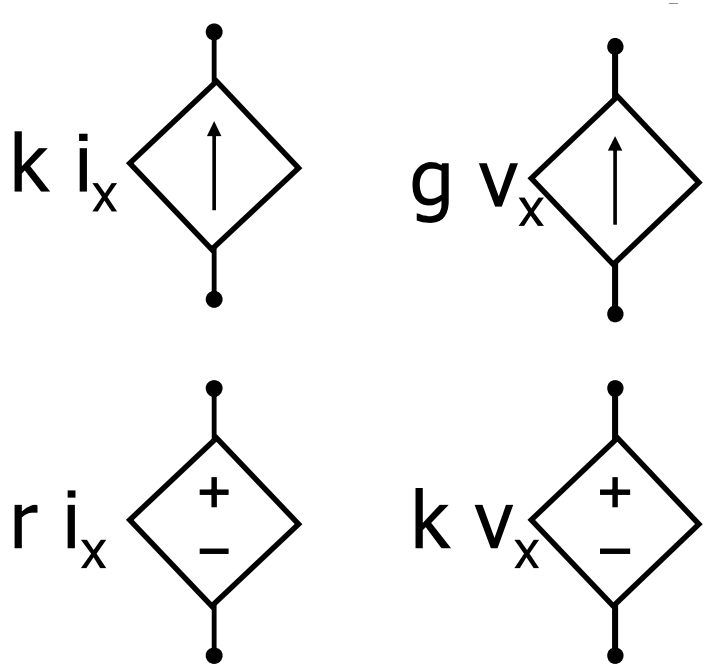
AC voltage source

Independent current source

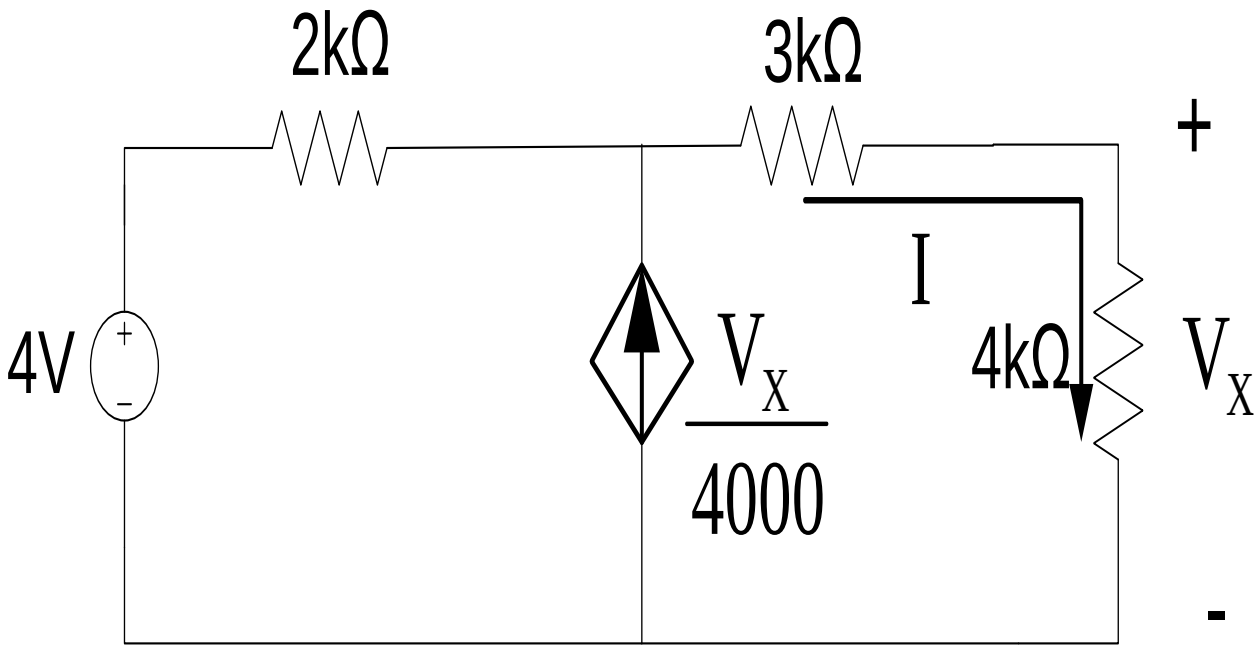
- The terminal current through this element is specified (independent of the voltage across the element)
- Circuit symbol below:



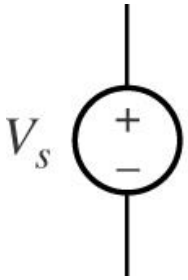
Dependent Sources



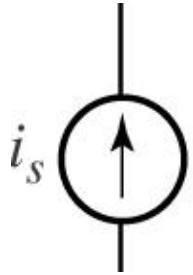
Dependent Current Source



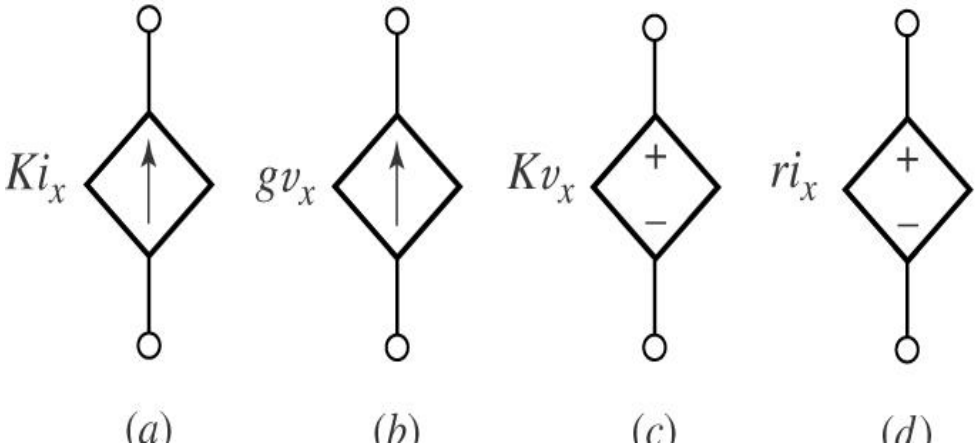
Circuit Symbol



Symbol for an independent voltage source.



Symbol for an independent current source.



The four different types of dependent sources: (a) current-controlled current source; (b) voltage-controlled current source; (c) voltage-controlled voltage source; (d) current-controlled voltage source.

Circuit symbols for various sources

Practical Examples

Ind. Voltage source – Battery, DC Generator, Alternator

Ind. Current source – Solar cell, Metadyne,CSI

Dependent Voltage Source – Controlled Alternator

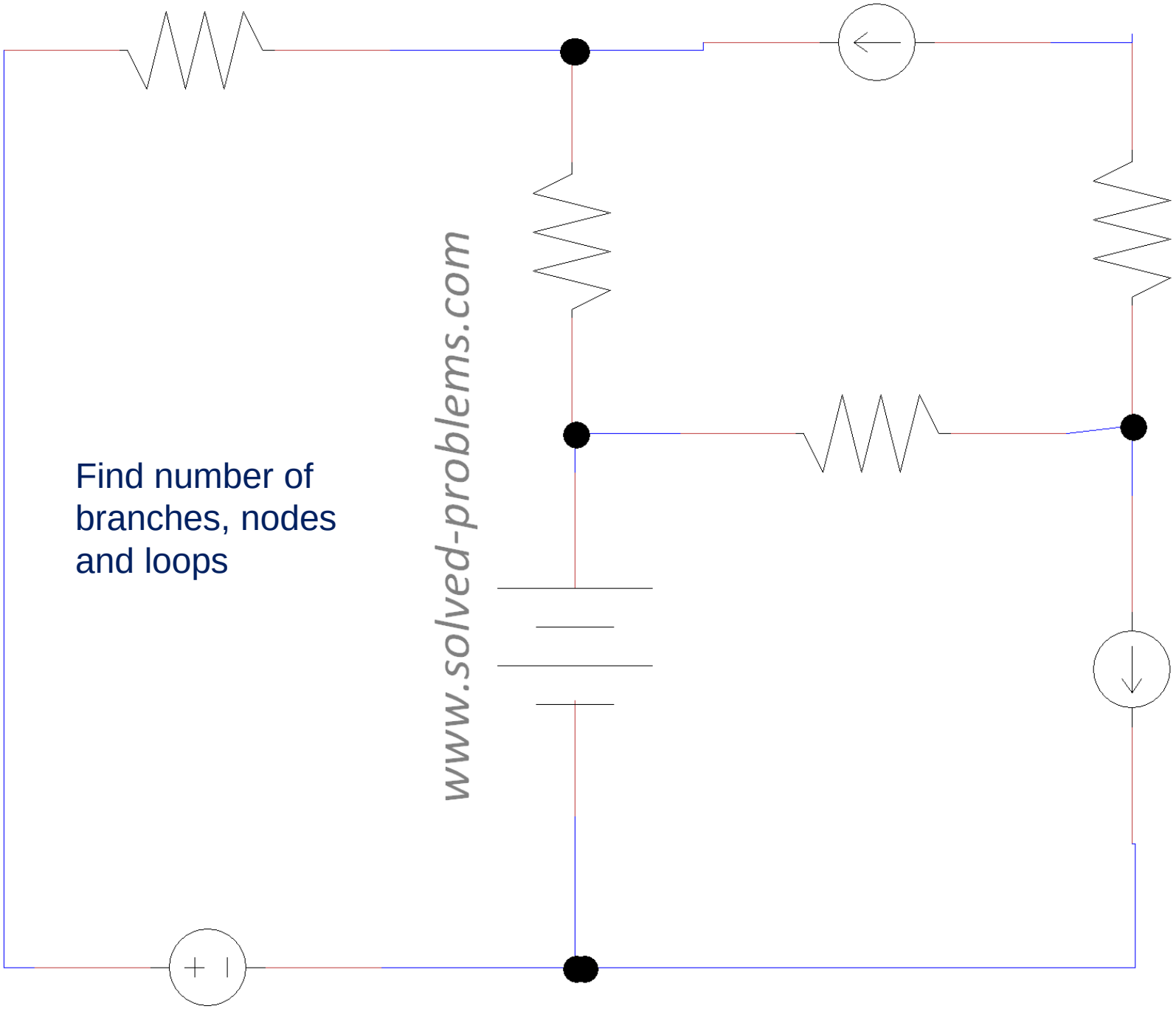
Dependent Current source – BJT (CCCS)

NODES, PATHS, LOOPS & BRANCHES

- A node is a point of connection of two or more circuit elements
- If we start at a node and move through an element to another node and so on (without encountering any particular node more than once), we trace a path through the network

- A loop is a closed path in a circuit
- A branch is a path composed of a single element with nodes at each terminal

Mesh is a LOOP with NO LOOP inside it.
A closed path in a circuit with NO other paths inside it.

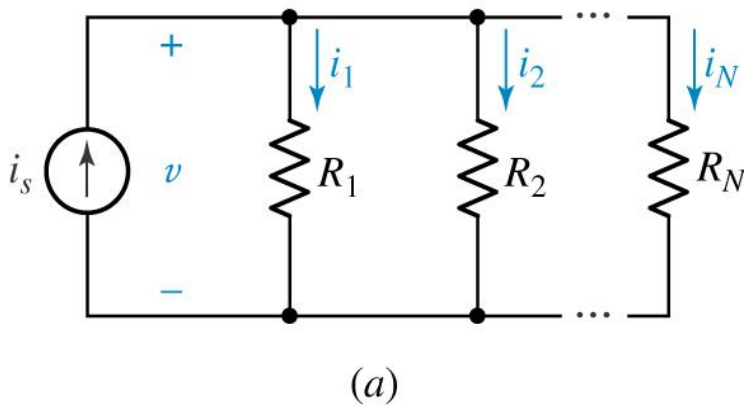

Find number of branches, nodes and loops
www.solved-problems.com

Kirchoff's Current Law (KCL)

Node : A point at which two or more elements have a common connection

KCL : The algebraic sum of the currents entering any node is zero.

Convention : Incoming currents to node is +ve
Outgoing current from node is -ve



(a)

KCL gives the equation

$$i_s - i_1 - i_2 \cdots - i_N = 0$$

Or,

$$i_s - \frac{v}{R_1} - \frac{v}{R_2} \cdots - \frac{v}{R_N} = 0$$

--The End --