

EE201
HOMEWORK 1

- 1) For the given circuits,
- assign element (branch) and currents.
 - write KVL and KCL equations.
 - obtain a set of equations involving only node voltages as unknowns.

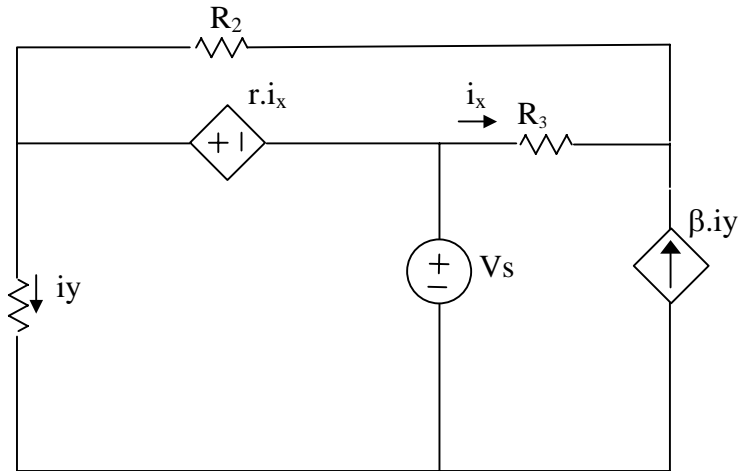


Figure1

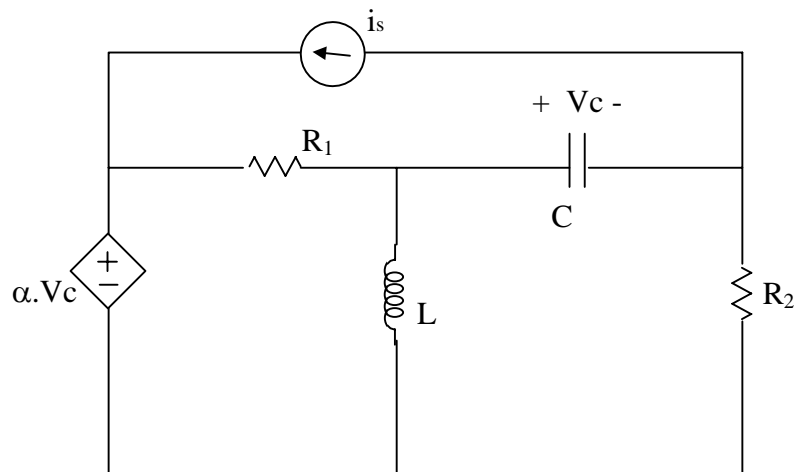
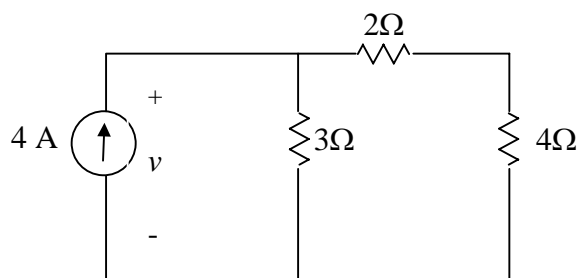
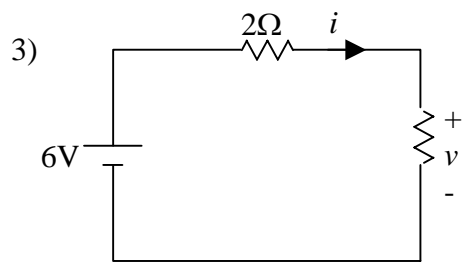


Figure2

- 2) For the given circuits below, find v and powers of all elements and the energy supplied by the source in 3 minutes.





Find v and i if,

- a) $v = 4i$,
 b) $v = [2 + \cos(3t)]i$
 c) $i = \begin{cases} \frac{1}{2}v^2 & v \geq 0 \\ 0 & v < 0 \end{cases}$

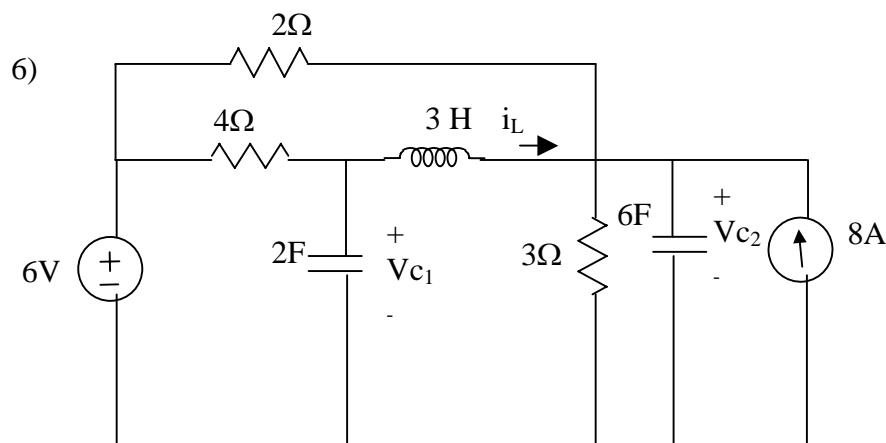
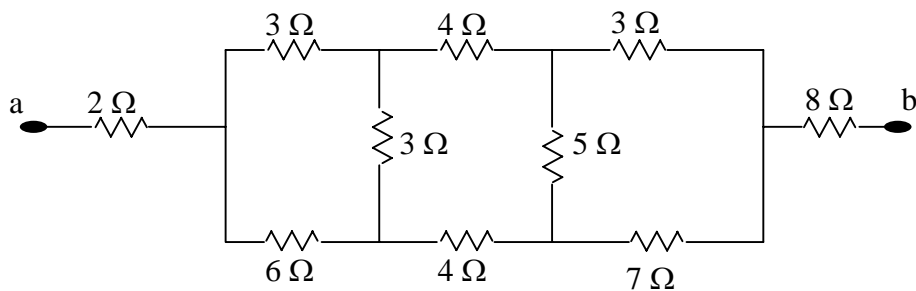
4) Indicate whether the following resistors are

- i) linear or nonlinear; ii) time-invariant or time-varying;
 ii) bilateral or nonbilateral; iv) passive or active; v) voltage controlled or current controlled.

a) $2v + 3i = 0$ b) $2v - 3i = 4$ c) $i = \cos(t) \cdot v$ d) $i = e^{-v}$ e) $i = v^4$ f) $v = i^5$

g) $v = [2 + \cos(3t)]i + 1$ h) $v = V_T \cdot \log_e((i/I_s) - 1)$; j) $i = \begin{cases} \frac{1}{2}v^2 & v \geq 0 \\ 0 & v < 0 \end{cases}$

5) Find the equivalent resistance between the terminals a & b.



$i_L(2.5) = -7 \text{ A}$

$V_{C1}(2.5) = 5 \text{ V}$

$V_{C2}(2.5) = 4 \text{ V}$

a) Draw the circuit graph; define the branch voltage and the branch current vectors.

- b) Write the terminal equations.
- c) Pick a reference node. Write the (reduced) incidence matrix.
- d) Write the mesh matrix.
- e) Pick a tree. Write the fundamental cutset and the fundamental loop matrices.
- f) Define the node voltage and the mesh current vectors.
- g) Write the independent current equations using the incidence matrix. Express the branch voltages in terms of the node voltages using the incidence matrix.
- h) Write the independent voltage equations using the mesh matrix. Express the branch currents in terms of the mesh currents using the mesh matrix.
- i) Write the independent current equations using the fundamental cutset matrix. Express the branch voltages in terms of the tree-branch (cutset) voltages using the fundamental cutset matrix.
- j) Write the independent voltage equations using the fundamental loop matrix. Express the branch currents in terms of the cotree-branch (loop) currents using the fundamental loop matrix.
- k) Draw the dual graph. Repeat the parts (d),(e) and (f) for the dual graph.
- l) Find the dual circuit.