GRAPH THEORY

1) The incidence matrix is given below as

Branches ① ② ③ ④ ⑤ ⑥ ⑦ ⑧

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & -1 & 1 & -1 \\ 0 & 0 & 0 & 1 & 0 & 0 & -1 & 0 \end{bmatrix}$$

Draw the oriented graph

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2) The fundamental cut-set matrix is given below

$$Q_s = \begin{bmatrix} 1 & 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$

Branch names ① ② ③ ④ ⑤ ⑥ ⑦

Draw the oriented graph.

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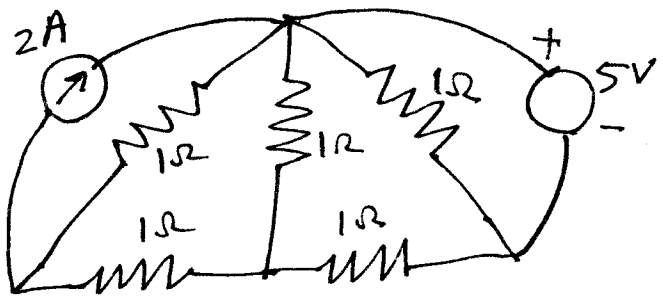
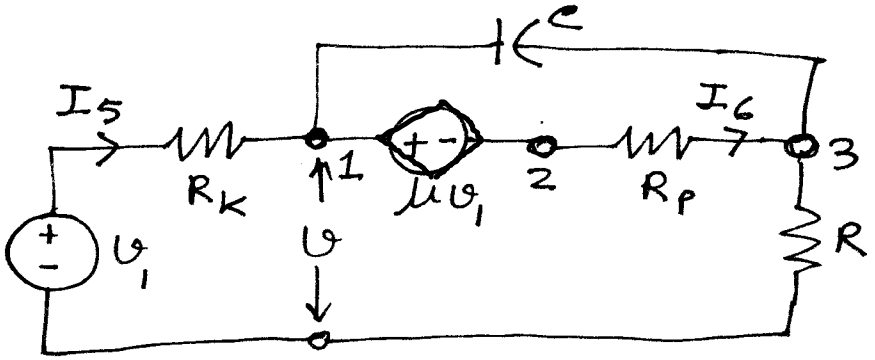
3) For the network below draw the graph. Write ~~the~~ a tie-set matrix (after sleleeting a tree and identifying the loops). Then obtain the equilibrium equations / mesh equations using the tie set matrix. solve the equations to get branch voltages and currents.



● [Hint: Choose the branches of the tree cleverly]

4)



Draw the graph and find a tree. Determine the loop matrix B, branch impedence matrix Z and source voltage vatrix V_S. Then write the loop equation. Solve for the current I_5. Determine the driving point admittance I_5/v_1.

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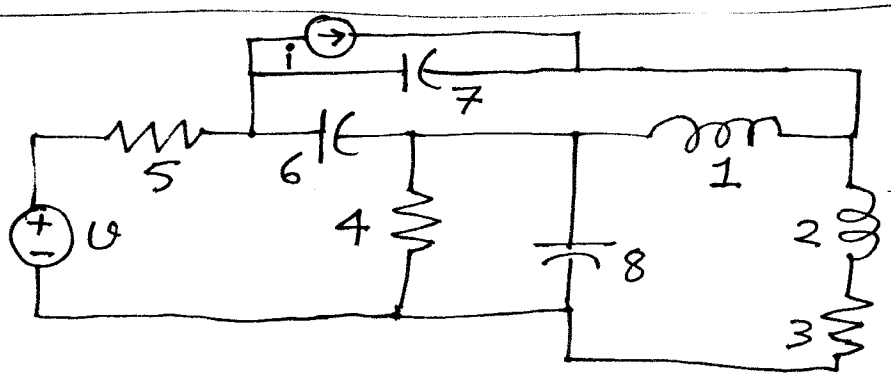
5)



~~Numbers~~
Numbers in this diagram represent branch indices (Not the value of the impedences)

Draw the directed graph. Choose a tree, write the cutset matrix, branch admittance matrix. Write the relation between twig and branch voltages. Write the KCL using the cutset matrix. Write the circuit equations / network equations using the cut set matrix. (You may use symbolic values for the resistances, inductances, capacitances)

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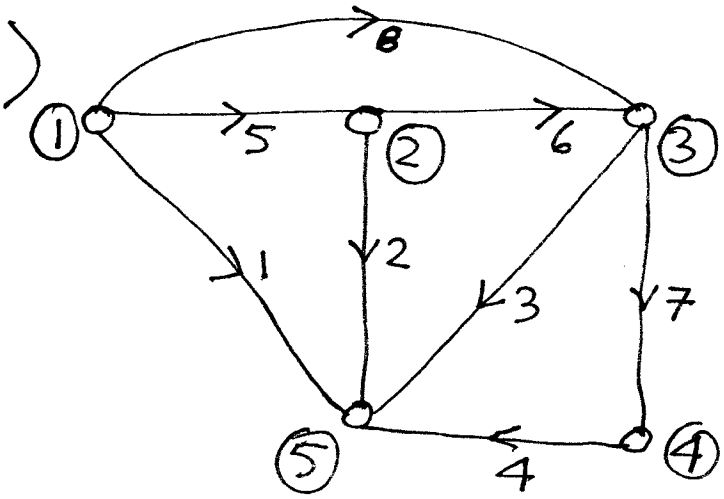
6)



Numbers inside circles are node numbers and numbers besides arrows are branch / edge number.

Write the incidence matrix of the graph and then express branch voltages interms of node voltages. Write a loop matrix B and express branch currents interms of the loop currents.