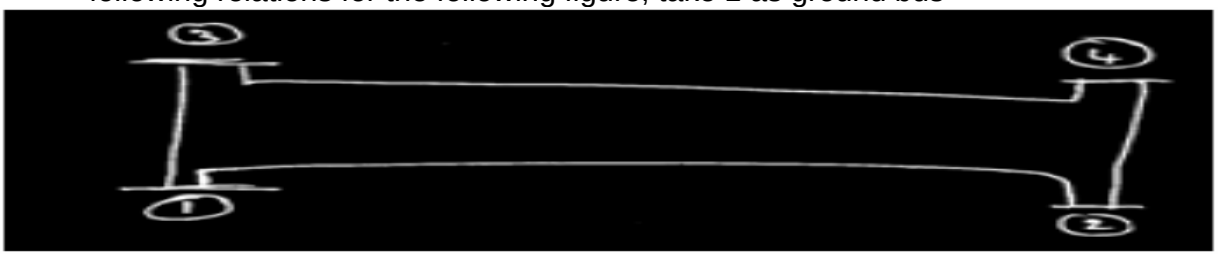
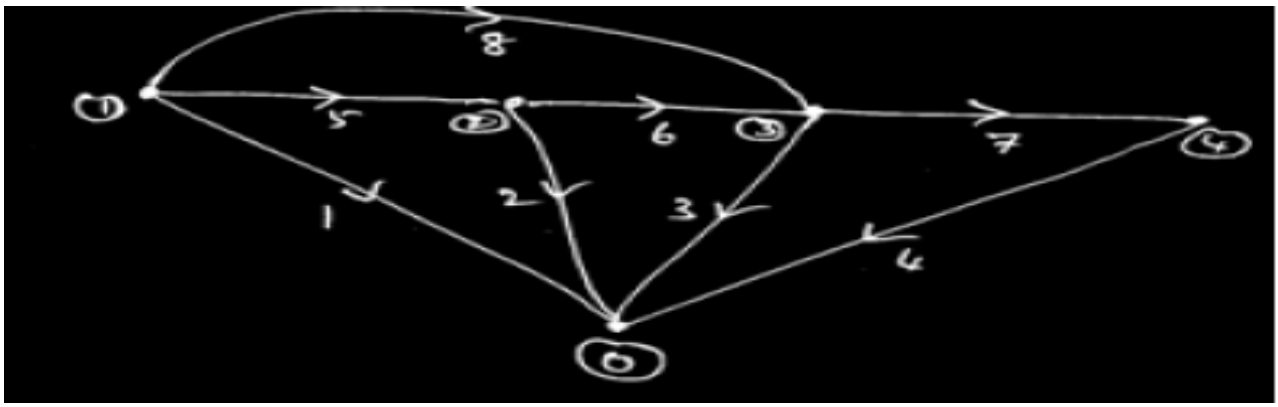
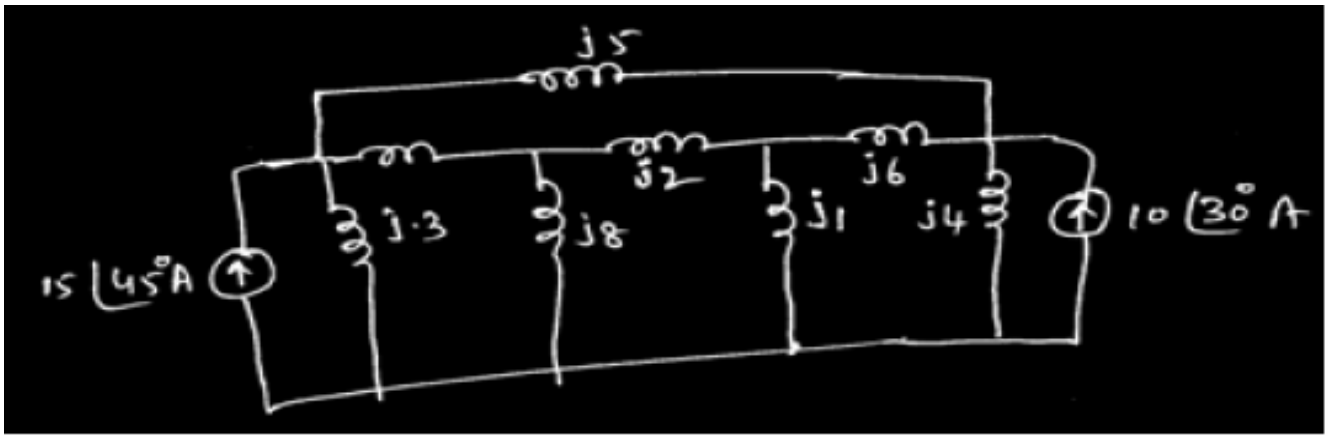
1) Determine the incidence matrices A, B, B' , C, C' and K. From that verify the following relations for the following figure, take 1 as ground bus



2) For the figure shown below, the impedance data is given in Table.1. Determine Y_{Bus} matrix by singular transformation method



3) (a) Prove the following relation with one example $A_b K_T = U$
(b) For the network shown in below figure, draw the graph and tree. Also determine the Y_{Bus} matrix by direct inspection method. All the mensioned values are impedance in p.u



4) (a) Define the following
(i) Tree (ii) cut set (iii) Tie set
(b) Bus incidence matrix is given below, draw the graph and tree

$$A = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \end{array} \begin{array}{c} \begin{array}{ccc} \textcircled{1} & \textcircled{2} & \textcircled{3} \end{array} \\ \begin{bmatrix} -1 & 0 & 0 \\ 1 & 0 & -1 \\ 1 & -1 & 0 \\ 0 & -1 & 1 \end{bmatrix} \end{array}$$