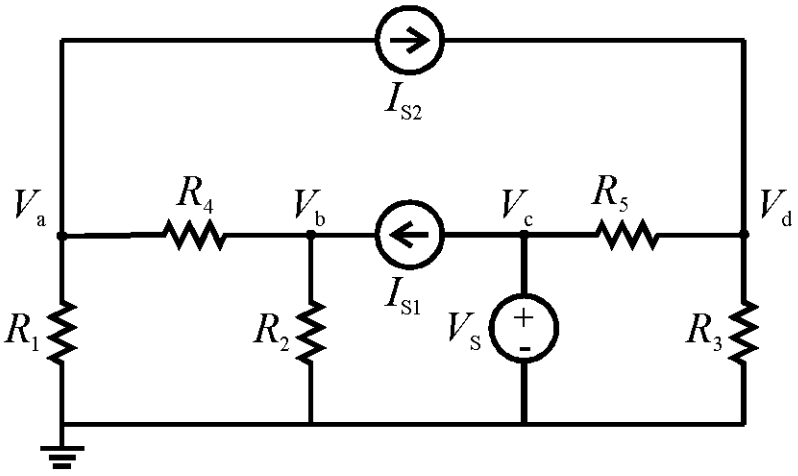
EE 220/220L Circuits I Examination 1

Name Example

Instructions: Show all work for full credit. Write answers in indicated places.

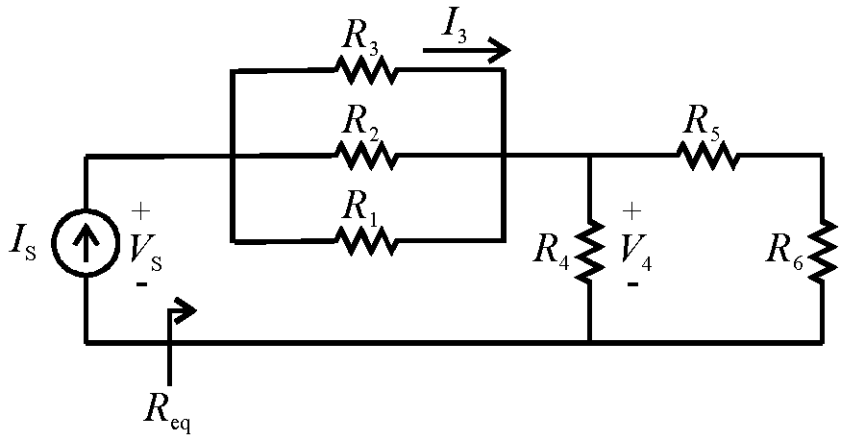
1) For the circuit shown, $R_1 = R_2 = 800\ \Omega$, $R_3 = R_4 = 500\ \Omega$, $R_5 = 400\ \Omega$, $V_S = 26$ V, $I_{S1} = 16$ mA, and $I_{S2} = 24$ mA. Using **nodal analysis**, write the node equations for nodes a-d below in the boxes below (Do NOT simplify). Then, solve for the node voltages.



Node a:
Node b:
Node c:
Node d:

$V_a =$ -7.01 V $V_b =$ 0.61 V $V_c =$ 26 V $V_d =$ 19.78 V

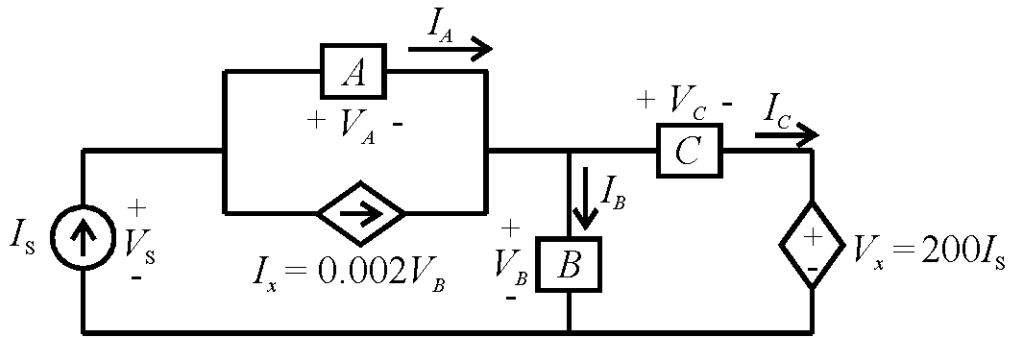
2) For the circuit shown, determine the total number of branches b, nodes n, and independent loops l. Then, use circuit reduction techniques (e.g., series resistance rule, current &/or voltage division ...) to find R_{eq}, V_S, I_3, and V_4. Given: $I_S = 40$ mA, $R_1 = R_4 = 1.5$ kΩ, $R_2 = R_6 = 800$ Ω, $R_3 = R_5 = 1.2$ kΩ. Show work for partial credit!



$b =$ 7 $n =$ 4 $l =$ 4

$R_{eq} =$ 1220.8 Ω $V_S =$ 48.83 V $I_3 =$ 12.12 mA $V_4 =$ 34.286 V

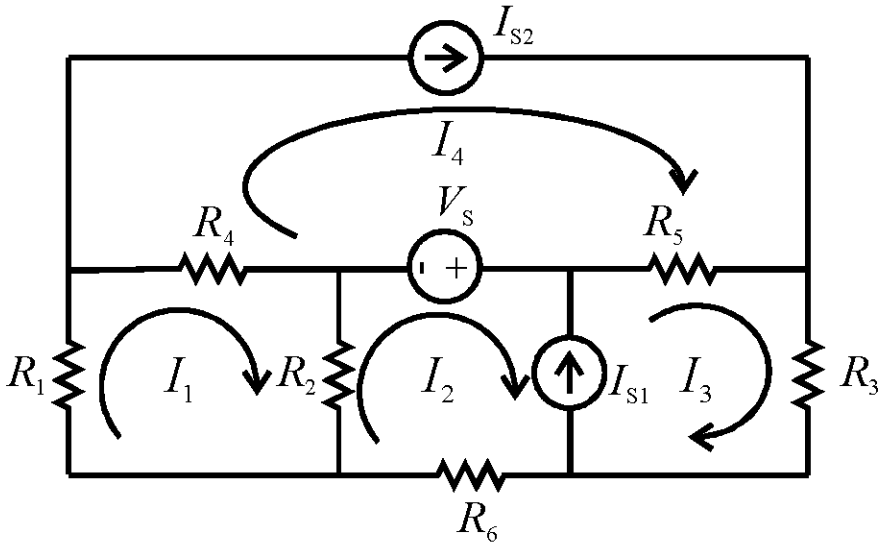
3) For the circuit shown, $I_S = 25$ mA, $V_A = 7$ V, $V_B = 18$ V, and $I_B = 12$ mA. Determine the voltages V_C, V_S & V_x, and currents I_A, I_C & I_x. Calculate the power absorbed by elements A and C.



$V_C =$ 13 V $V_S =$ 25 V $V_x =$ 5 V $P_A =$ -77 mW

$I_A =$ -11 mA $I_C =$ 13 mA $I_x =$ 36 mA $P_C =$ 169 mW

4) Using **mesh analysis** techniques, write the mesh equations (in the boxes below) required to determine the mesh currents I_1, I_2, I_3, and I_4 when $R_1 = R_3 = 80\ \Omega$, $R_2 = R_4 = 50\ \Omega$, $R_5 = R_6 = 40\ \Omega$, $V_S = 26$ V, $I_{S1} = 160$ mA, and $I_{S2} = 240$ mA. Use given values in equations and do NOT simplify. Indicate perimeter(s) of supermeshes with dashed line(s).



Mesh 1
2/3 Supermesh
2/3 Aux. eq'n
Mesh 4