The University of Sheffield
Department of Electronic and Electrical Engineering

EEE117 Problem Sheet

dc Circuit Analysis

Q1 For the circuit of figure 1 find I using any method you like. What is the power dissipation in R_1? [-0.25 A, 10.5 W]

Q2 Using any method you like, find the values of I and V in figure 2. [-2.89 A, 16.89 V]

Q3 In figure 3, I is initially 1 A. Use nodal analysis to find V_R and hence find I_S. What value of I is necessary to give $V_R = -4$ V? [3.2 V, 0.6 A, -5 A]

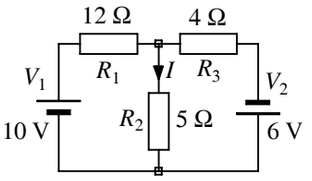

Figure 1

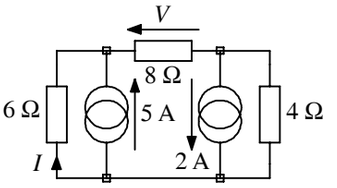

Figure 2

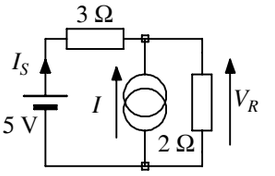

Figure 3

Q4 For the circuit of figure 4, use nodal analysis and superposition to find I_1 and the potential difference $V_4 - V_3$, $V_{4\text{-}3}$. What is the power dissipation in R_4? [-0.15 A, 15.38 V, 23.2 W]

Q5 Use loop analysis and superposition to find I_2 and I_4 in the circuit of figure 5. State with brief reasoning which component could be replaced by a short circuit without affecting either of these currents. [2.93, -2.18, 12 Ω]

Q6 Find $V_2 - V_3$, V_{23}, in the circuit of figure 6 using any method you like. [1 V]

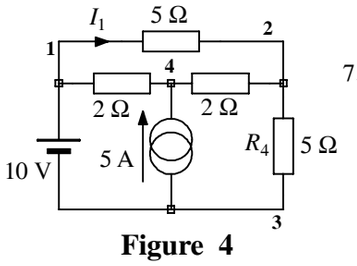

Figure 4

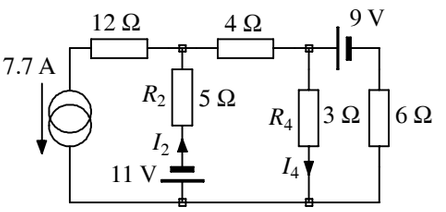

Figure 5

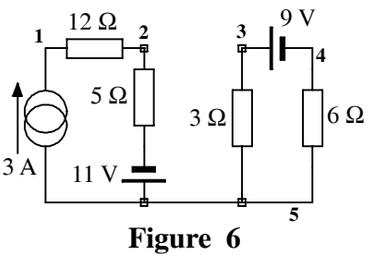

Figure 6

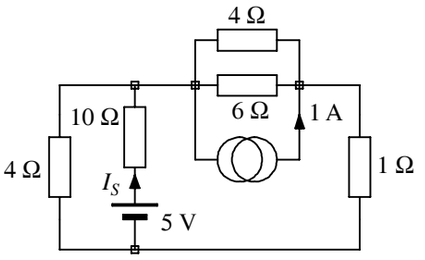

Figure 7

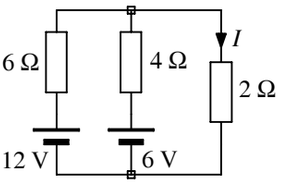

Figure 8

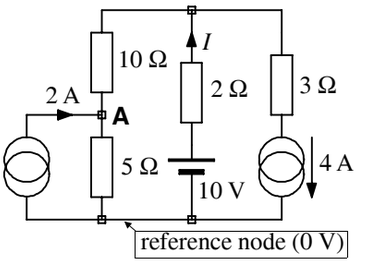

Figure 9

Q7 Use the principle of superposition to work out I_S in figure 7.

Q8 Use the principle of superposition to find I in figure 8.

Q9 Use nodal analysis to find the voltage at node **A** with respect to the reference node in figure 9. Check your answer using the principle of superposition. Using your knowledge of $V_{\mathbf{A}}$, or by other means, calculate the value of I.

Q10

(a) Use **(i)** nodal analysis and **(ii)** loop analysis to work out the value of current I in the circuit of figure 10.

(b) Which of the five resistors dissipates the largest power?

(c) Evaluate the power in part **(b).**

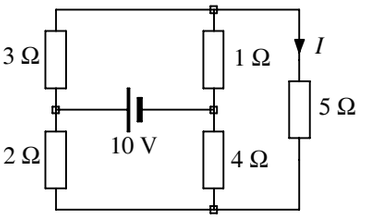

Figure 10

Q11 **This question is quite challenging - attempt it only if you have completed all the rest.** Use the principle of superposition to find I_S and V_R in the circuit of figure 11. [1 A, 5 V].

(*Hint: draw out the partial circuit for each source you consider and look for ways to simplify these circuits by combining resistors. You may have to use loop or nodal methods on the partial circuits. To help you check each of your superposition calculations, the voltage at nodes 2, 3, 4 and 5 for each source, with respect to node 0, is given. Node 1 is straightforward. It is easy to evaluate V_R and I_S for each source from these.*

V_1: 7.2222, 3.8889, 7.2222, 5.0000.

V_2: 4.1667, -0.8333, -5.8333, -2.5000

I_1: 1.1111, -5.5556, 1.1111, -10.0000)

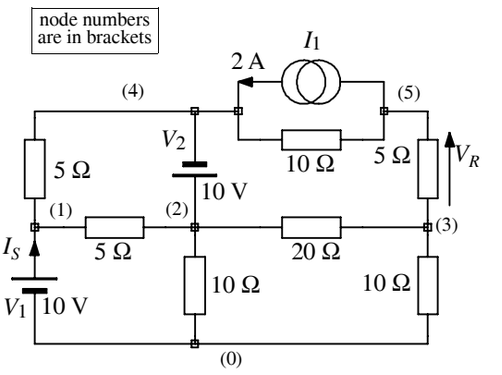

Figure 11