Engineering Faculty
Electrical department
1st year electrical

Electric circuits
2015 / 2016
Time 3 hours

Problem 1: Apply DC techniques to solve the following circuits

a) Use nodal voltage analysis to find v_o in the circuit shown in Figure 1. (10 Marks)

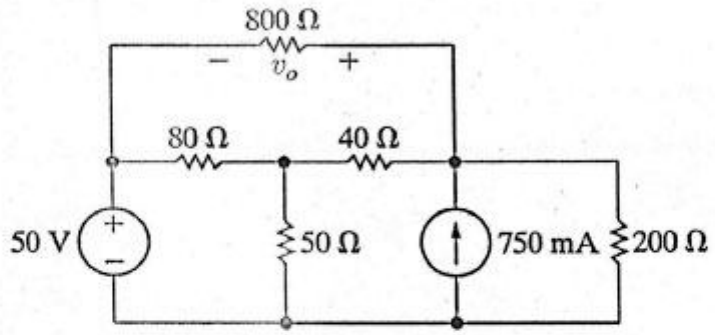

Figure 1

b) Use mesh current analysis to find v_o in the circuit shown in Figure 2. (10 Marks)

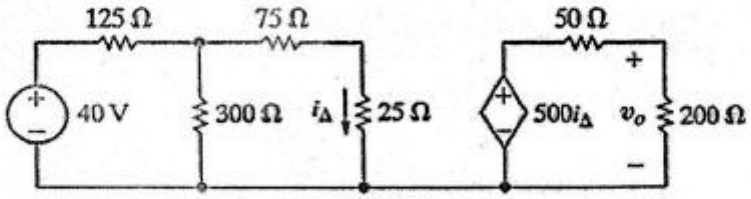

Figure 2

c) Use the principle of superposition to find i_o in Figure 3. (5 Marks)

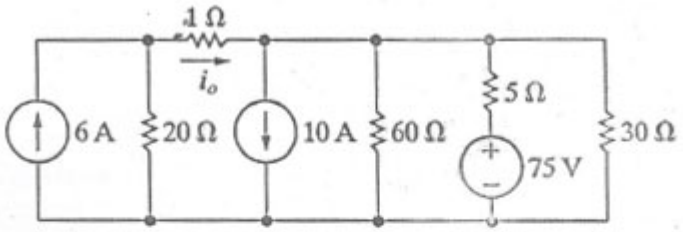

Figure 3

Problem 2: Apply DC techniques to solve the following circuits

a) Make a series of source transformations to find the voltage v_o in Figure 4. (5 Marks)

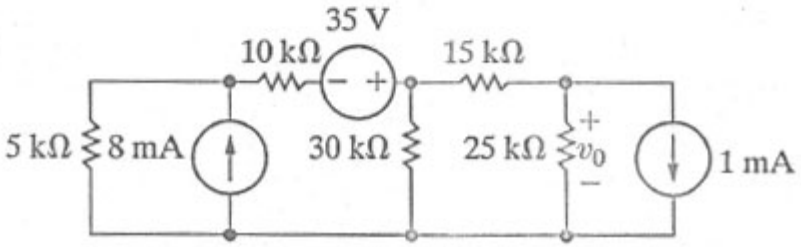

Figure 4

b) Find R_{eq} and i_o in the circuit in Figure 5. (5 Marks)

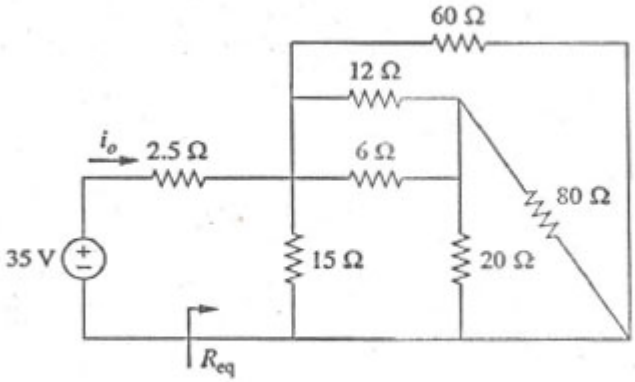

Figure 5

c) In the circuit shown in Figure 6, find

- Thevenin's equivalent circuit between terminals a and b.
- The value of R_o that achieves maximum power transfer.
- The value of maximum power that can be delivered to R_o.

(10 Marks)

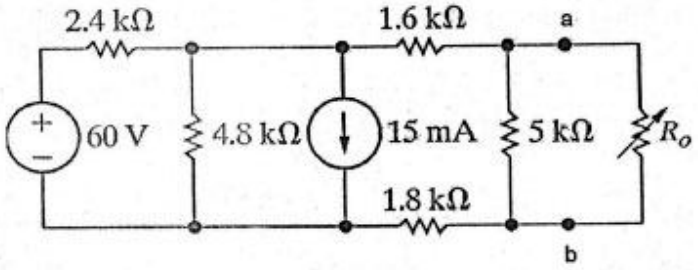

Figure 6

d) Find i_L in the circuit shown in Figure 7 (5 Marks)

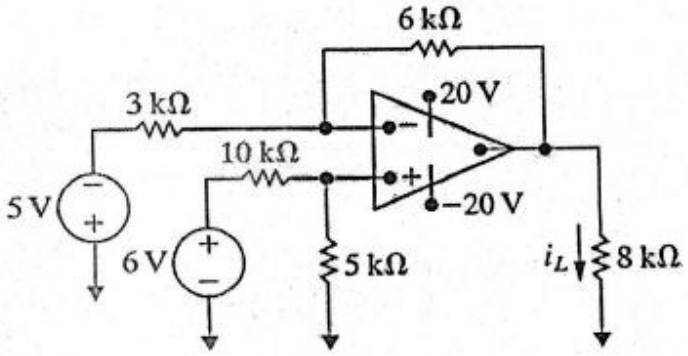

Figure 7

Problem 3: Solve the following first order or second order circuits

a) The switch in the circuit in Figure 8 has been in position 1 for a long time. At t=0 the switch moves instantaneously to position 2. Find $v_o(t)$ for $t > 0$. (7.5 Marks)

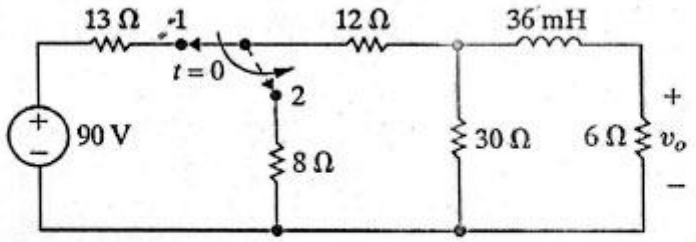

Figure 8

b) The switch in Figure 9 was closed at t=0 after being open for a long time. Find:
- $i_1(t)$ for $t > 0$
- $i_2(t)$ for $t > 0$

(7.5 Marks)

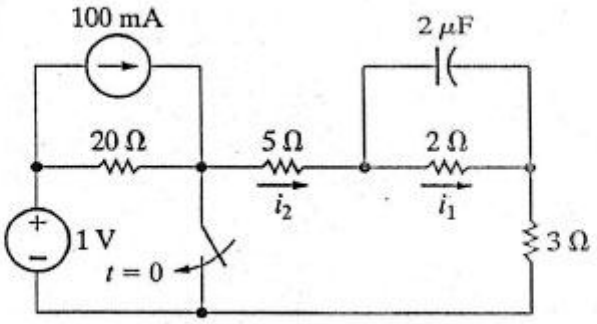

Figure 9

c) In the circuit shown in Figure 10 , the resistor is chosen such that the circuit is critically damped. The initial capacitor voltage is 15 V and the initial inductor current is 6 mA. Find the value of R, then find $v_c(t)$ and $i(t)$ for $t > 0$. (10 Marks)

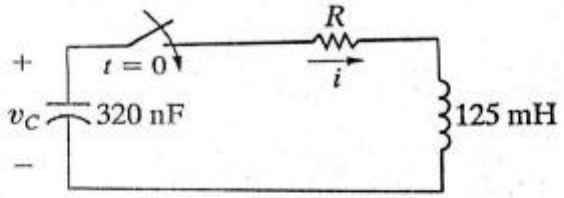

Figure 10

Problem 4: Solve the following AC problems

a) Find the input admittance for the circuit shown in Figure 11.(5 Marks)

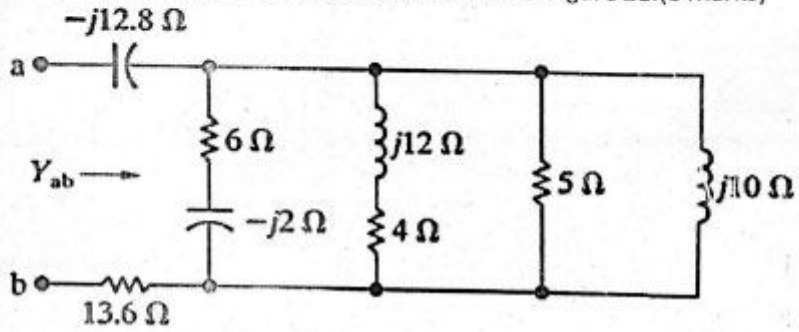

Figure 11

b) Use source transformations to find thevenin's equivalent circuit between terminal a and b in Figure 12. (5 Marks)

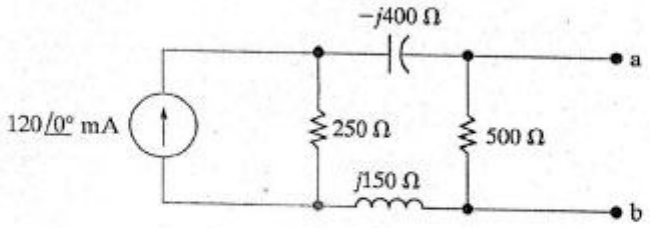

Figure 12

c) Use nodal analysis to find the voltage V_g and current I_g in the circuit shown in Figure 13. Then find the complex power supplied by the voltage source and current source. (10 Marks)

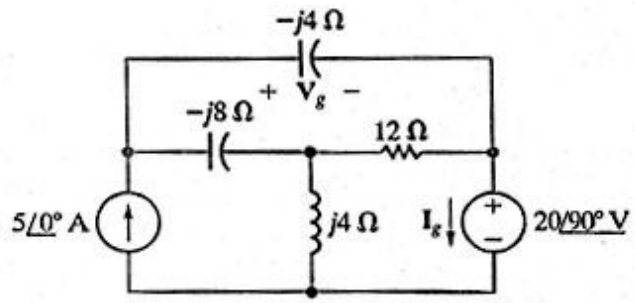

Figure 13

d) Three loads are connected in parallel to a 120 ∠0 V source. Load 1 absorbs 60 kVAR at pf=0.85 lagging, load 2 absorbs 90 kW and 50 kVAR leading, and load 3 absorbs 100 kW at pf=1.

- Find the equivalent impedance.
- Calculate the power factor of the parallel combination.
- Determine the current supplied by the source.

(5 Marks)