EE 111 : Tutorial 01

1. For the circuit shown in the figure 1 obtain the Thevenin equivalent source and resistance as seen across the terminals of the capacitor. From this obtain the expression for response V_0, if a step input of 10 V is applied at $t = 0$. Assume that the initial charge across the capacitor is zero. Using the above result derive and sketch the output voltage $V_0(t)$ when a square wave of $500Hz$ of levels $+10V$ and $-10V$ is applied to the circuit.

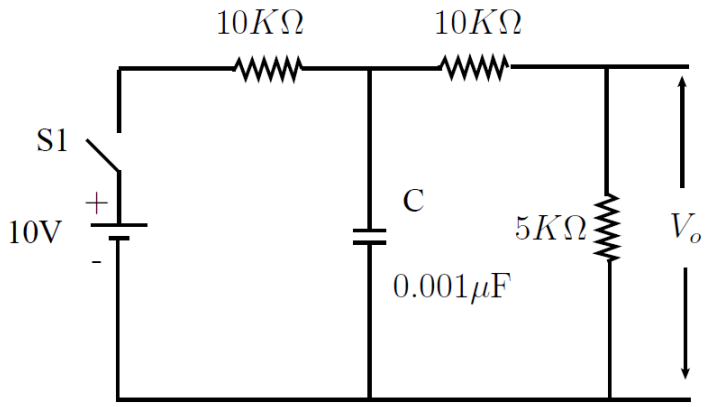

Figure 1:

2. In the circuit of figure 2, initially the capacitor has no charge. Switch S1 is closed at $t = 0$ seconds with switch S2 kept open. Sketch the complete waveform of the current i and voltage across the capacitor Vc if the switch S2 is closed
   (a) at $t = 2$ msec
   (b) at the instant $V_c = 5V$.

3. If the interconnection in figure 3 is valid, find the total power developed in the circuit. If the interconnection is not valid, explain why?

4. (a) Find the voltage V_y in the circuit in figure 4.
   (b) Show that the total power generated in the circuit equals the total power absorbed.

5. The currents i_a and i_b in the circuit in figure 5 are $4A$ and $2A$ respectively.

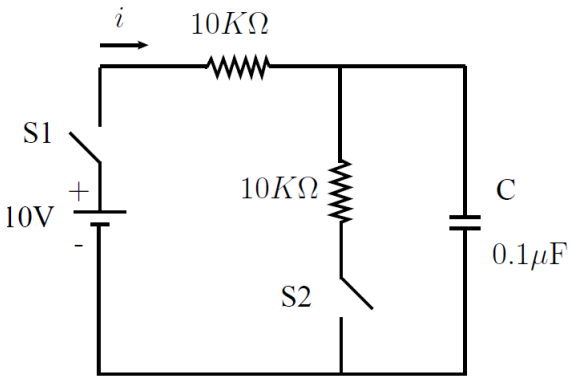

Figure 2: Figure

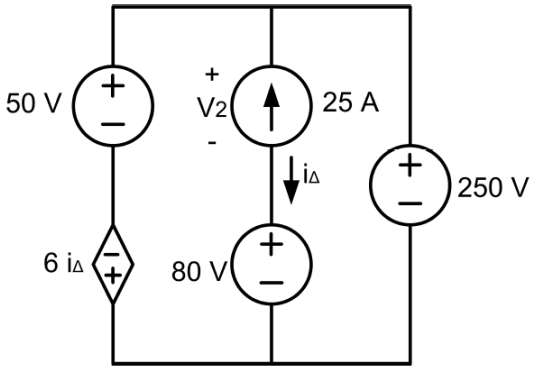

Figure 3:

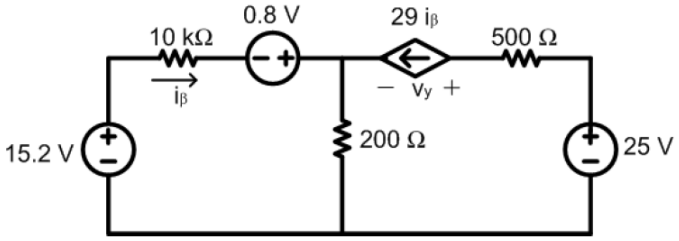

Figure 4:

(a) Find i_g.

(b) Find the power dissipated in each resistor.

(c) Find v_g.

(d) Show that the power delivered by the current source is equal to the power absorbed by all the other elements.

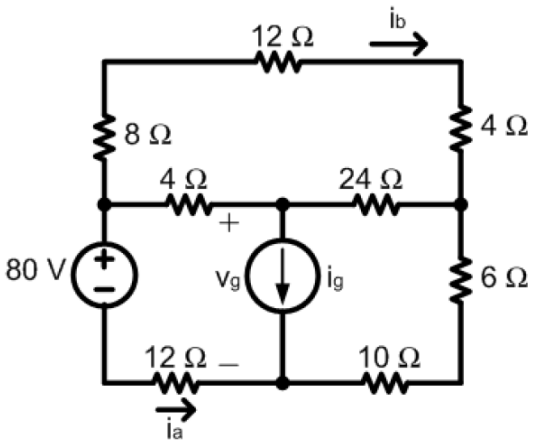

Figure 5:

6. Find V_1 and V_g in the circuit shown in figure 6, when V_o equals $250mV$. (Hint: Start at the right end of the circuit and work back toward V_g)

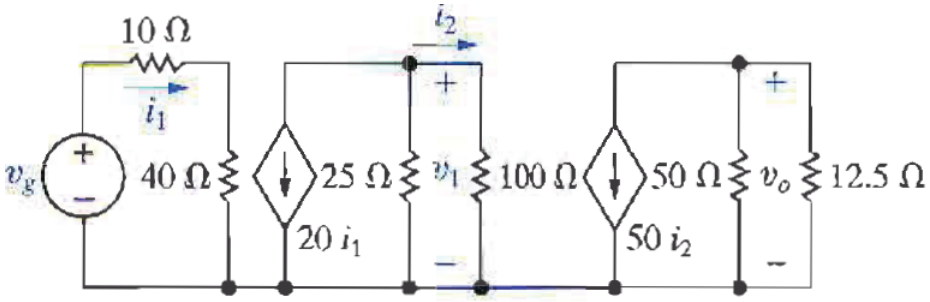

Figure 6:

7. The switch in the circuit in figure 7 has been open for a long time before closing at $t = 0$. Find i_o(t) for $t \geq 0$.

8. The switch in the circuit shown in figure 8 has been in the OFF position for a long time. At $t = 0$, the switch moves instantaneously to the ON position. Find V_o(t) for t ≥ 0.

9. With the ac voltage source in the circuit shown in figure 9, operating at a frequency of f, it was found that $I = 1.0\angle 0^0 A$. When the source frequency was doubled (2f), the current became $I = 0.707\angle -45^0 A$. Find:

   (a) The frequency f

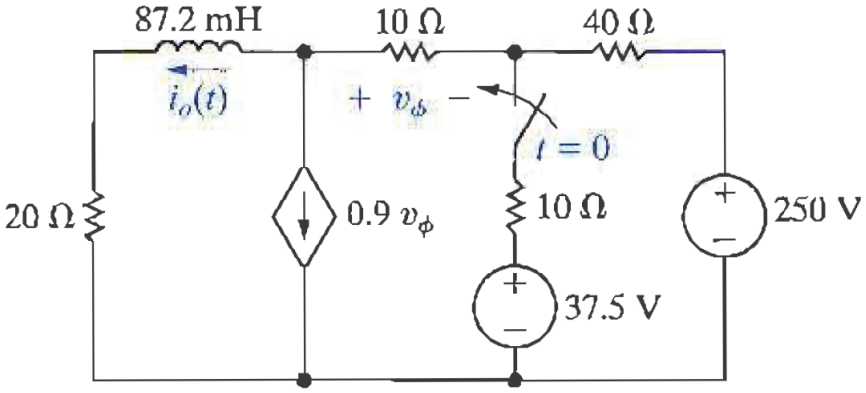

Figure 7:

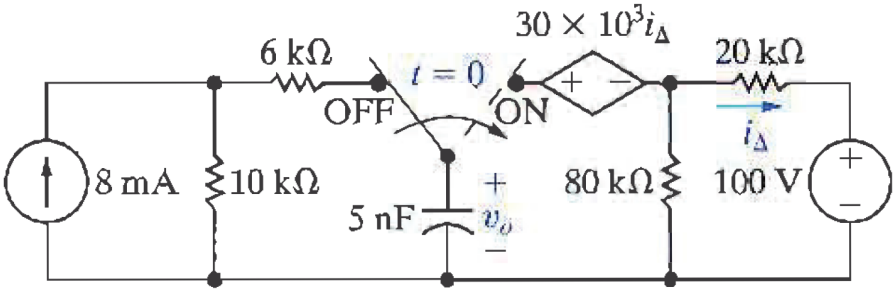

Figure 8:

(b) The inductance L, and also the reactances, X_L and X_C at $2f$.

10. A coil, having a resistance of 15 Ω and an inductance of 0.75 H, is connected in series with a capacitor (figure 10a). The circuit draws maximum current, when a voltage of 200 V at 50 Hz is applied. A second capacitor is then connected in parallel to the circuit (figure 10b). What should be its value, such that the combination acts like a non-inductive resistance, with the same voltage (200 V) at 100 Hz? Calculate also the current drawn by the two circuits.

11. The total voltage waveform shown in figure 11a is applied to the circuit of figure 11b. The initial current in the inductor is zero.
(a) Calculate $v_0(t)$
(b)Make a sketch of $v_0(t)$ versus t
(c) Find $i_0(t)$ at $t = 4\mu s$

12. The gap in the circuit seen in figure 12 will arc over whenever the

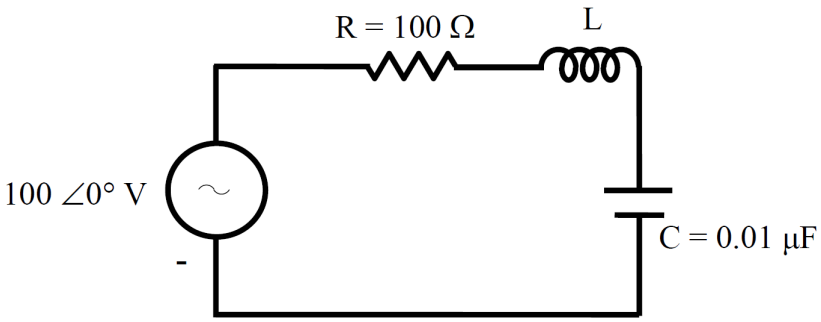

Figure 9:

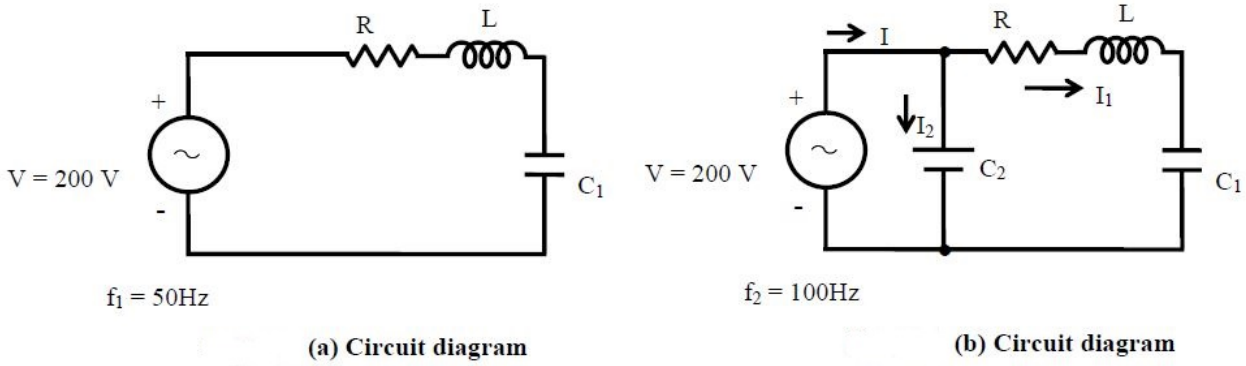

Figure 10:

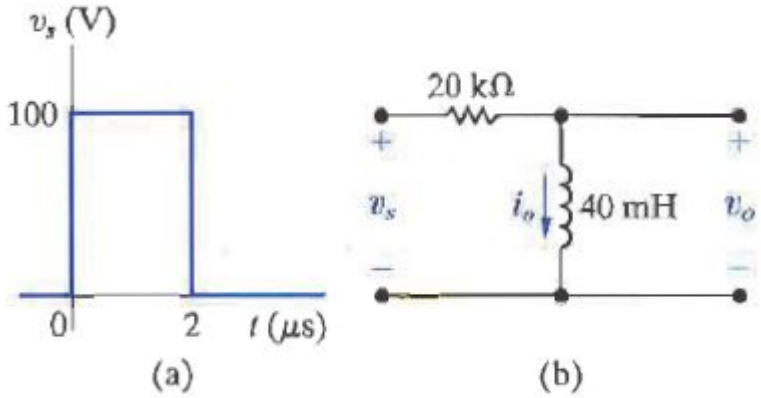

Figure 11:

voltage across the gap reaches 36KV. The initial current in the inductor

is zero. The value of β is adjusted so the thevenin resistance with respect to the terminals of the inductor is -3kΩ.
(a) What is the value of β ?
(b) How many microseconds after the switch has been closed will the gap arc over?

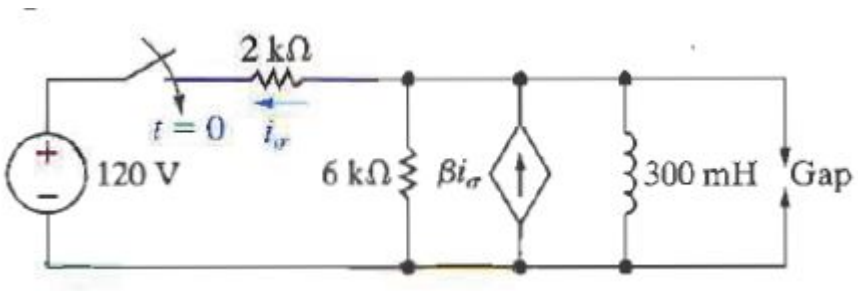

Figure 12:

13. A balanced star connected load is supplied from a symmetrical 3 phase, 400 V, ABC system. The current in each phase phase is 30 A and lags $30\angle 0^0$ behind the phase voltage. Find:
(a) The phase voltage
(b) Load impedance
(c) The total power
(d) Total reactive power
(e) The wattmeter readings (current coils are in phase A and C if two wattmeter method is used to measure the power drawn from the load. Draw the complete vector diagram.

14. A 3 phase, 400V delta connected system has the loads: Branch RY, 20kW at power factor lagging 1.0; branch YB, 30kVA at power factor 0.8 lagging; branch BR, 20kVA at power factor 0.6 leading. Find the line currents and readings on wattmeter whose current coils are in phases R and B.

15. Calculate the active and reactive current components in each phase of star connected 10000V, 3 phase generator supplying 5000kW at a power factor of 0.8. If the total current remains the same when the load power factor is raised to 0.9, find the new output.