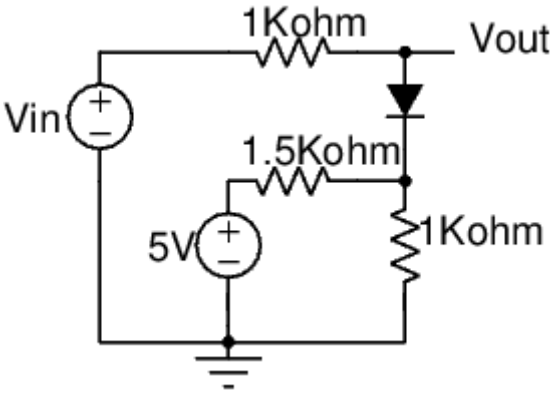
Tutorial 6

Part-1

Note: All Diodes have a forward drop of 0.7V.

1) Given that aluminum wires can tolerate current densities upto 1 MA/cm^2 , find the maximum values of the current through and the voltage across the wire for a 500um long, 3um wide and 1um thick aluminium. (Resistivity of Aluminium is 2.7*10^{-8} ohm-meter).

2) For the circuit shown, measure Vout for a) Vin = 1V b) Vin = 3V

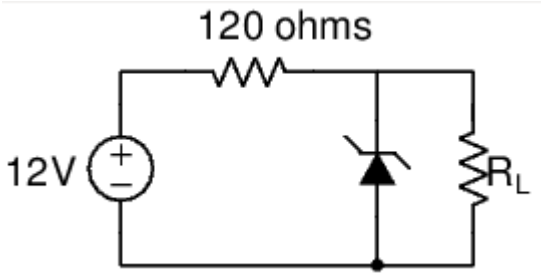


3) In the circuit diagram, the zener diode has V_Z = 5V.

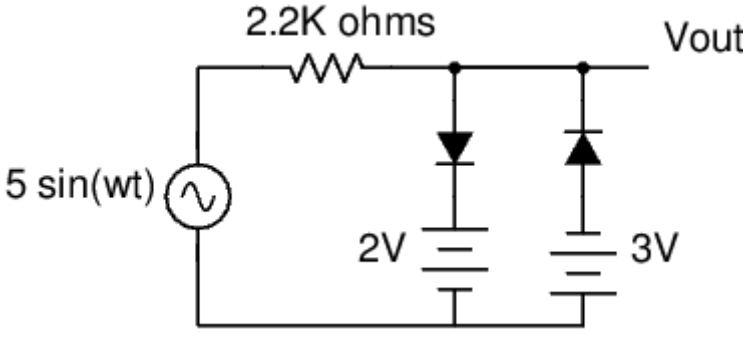
a) Measure V_{RL} , I_Z and I_{RL} for R_L = 60 ohms.

b) Measure V_{RL} , I_Z and I_{RL} for R_L = 120 ohms.

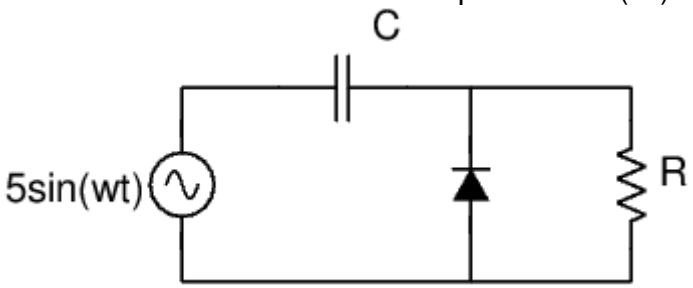
c) Given the maximum power rating of zener is 150mW. Find a range of value for R_L for which the zener diode is operational.



4) Plot the output voltage and the diode currents for the network with an input of 5*sin(wt).

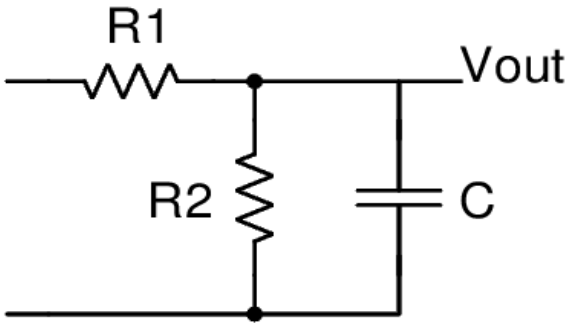


5) Plot the output waveform for the network with an input of 5*sin(wt) at steady state.



Part-2 (NGSpice)

1) For the circuit shown below R1 = R2 = 10Kohms and C = 1uF. Perform the following.



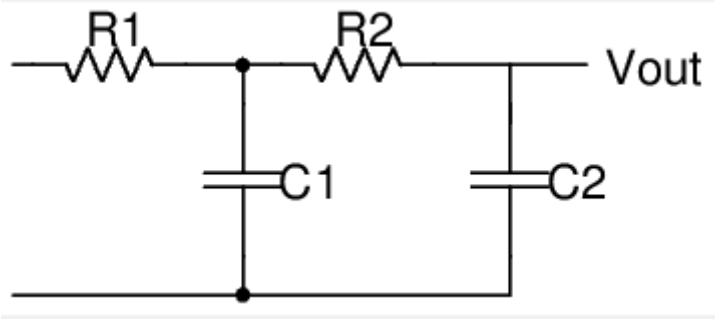
a) With a step input of 5V, measure the time needed to charge the output to 99% of the final value using NGSpice ?

b) Obtain the time constant of the circuit theoretically. How does the time obtained in part a compare with 5*time constant ?

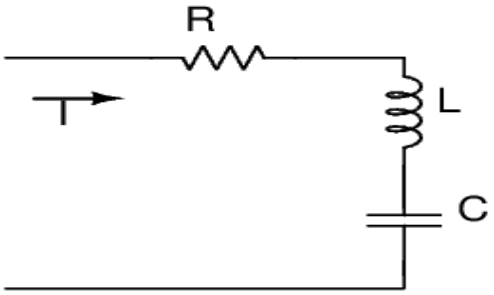
c) Find the cut-off frequency of the circuit using ac analysis in NGSpice ?

d) How does this cut-off frequency relate with the time constant that was calculated in part b?

2) For the circuit shown below, with R1= R2 = 10Kohms and C1=C2=1uF. Repeat part a, b ,c and d of problem 1 for this circuit.



3) A series RLC circuit is shown in the figure below with R=10kOhms, L=25mH and C=1uF.

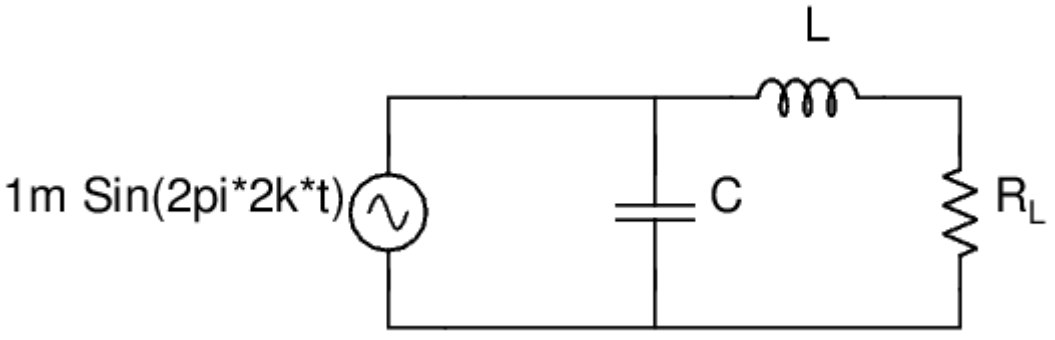


a) Find the resonant frequency of the circuit by simulation in NGSpice.

b) Find the Bandwidth of the network from simulation. Hence obtain the Quality factor from the information available.

c) Apply a sinusoidal input with 0.5V amplitude and resonant frequency as the input frequency to the circuit. Measure the voltage across capacitor and inductor at steady state and compare the voltage with the Quality-factor that was obtained in part b.

4) Apply an input sinusoid of 1mv amplitude and 2kHz frequency to the circuit shown below. The values of C=25.62mF, L=6.89mH and load RL = 50ohms.



a) Plot the input voltage and input current of the circuit in NGSpice. Is the impedence looking in real or complex ? How does it relate to the load resistance RL?(Impedence matching).

b) Plot the voltage across and current through the load in NGSpice. How much of the input power is being delivered to the load RL?

5) Generate the following waveform in NGSpice and apply this as an input to a series RC circuit with R=1Kohms and C=1uF . Plot the output voltage across capacitor.