Simulation Exercise: Rectifier

1. Write ngspice netlist for the following half wave rectifier circuit shown in Fig.1. Run the simulation and observe input and output voltage waveforms and diode current waveform for Vs = 10Vpp, 500Hz sinusoidal signal, R_L=1K and for a) default diode b) 1N914 diode (use the Model library for model file of 1N914 diode on the course webpage under Software Manuals).

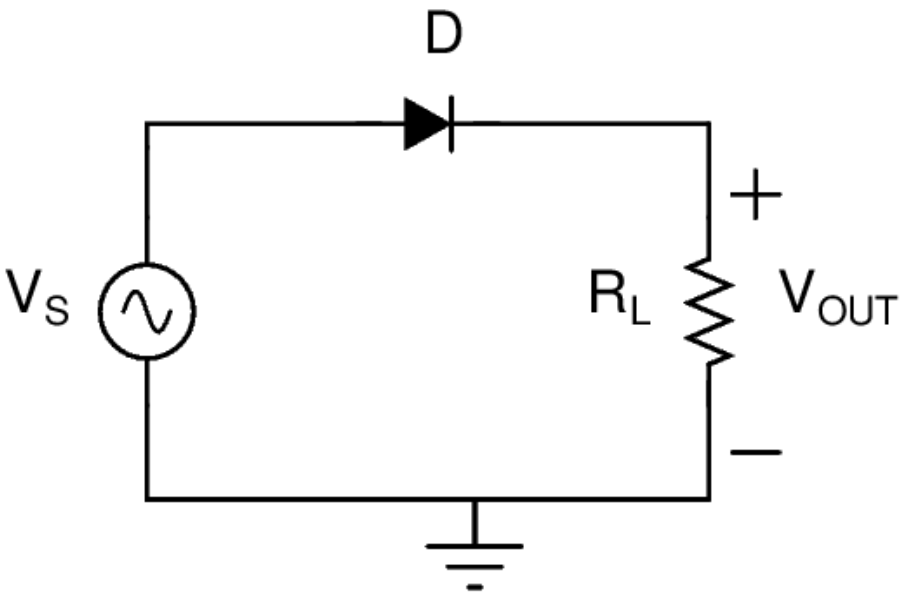

Figure 1: Half wave rectifier

2. Now connect a capacitor of 4.7 μF across the load resistor R_L. Modify the netlist and again run the simulation to observe the input and output voltage waveform and also observe the waveform of the current through diode.

3. Comment on these waveforms. Why does the diode not conduct continuously when the capacitor filter is connected?

4. Vary the value of capacitor to 10μF, 47μF, and 100μF and observe the effect. Repeat for R_L=10K. Tabulate the readings in each case to estimate the ripple factor in Table 1 below.
   Note: V_{R-PP} is peak-to-peak value of ripple voltage.

$$V_{R-RMS} = \frac{V_{R-PP}}{2\sqrt{3}} \tag{1}$$

$$V_{DC} = V_P - 0.5V_{R-PP} \tag{2}$$

Sr.No	R_L kΩ	C μF	V_{rpp}	V_{DC}	r
1	1	4.7			
2		10			
3		47			
4		100			
5	10	4.7			
6		10			
7		47			
8		100			

Table 1: The observation table to be filled in