Lab-1
Analog Circuits

Diodes: Experiment List

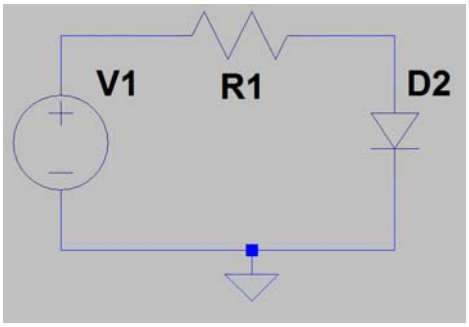
In this session you should explore the functions of the LTSpice program. Based on the class lecture and build in help of the program, perform simulation related to the diode applications. Discuss with your group mates. If you have any difficulty, you may consult TAs.

Components required for this lab:

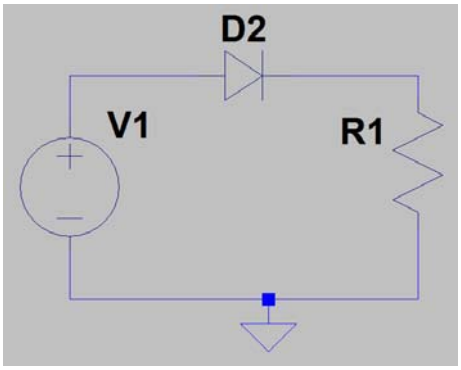
1. 1N4148 diode
2. 1K Ω resistor
3. 1M Ω resistor
4. 22u capacitor
5. 10M Ω resistor

Plot the waveform for all the below exercises.

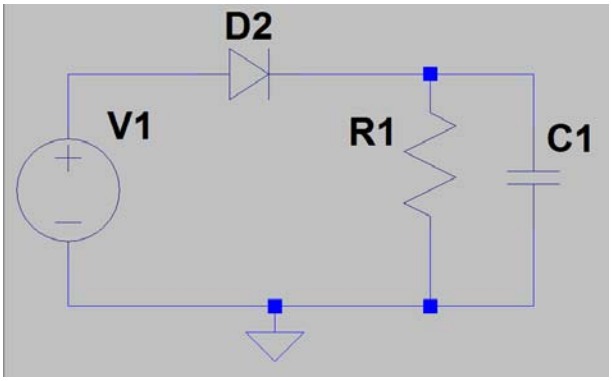
1. Design the circuit parameters to simulate for **diode I-V characteristics**, forward and reverse bias (R = 1M Ω) characteristics. (Can we use lower value resistor like 1K or 10K and specify that V1 should be varied from -10V to -10V so that max current will be less than 10 mA.)



2. Perform transient simulation of the Half-**Wave Rectifier** circuit with the below parameters. Use a 60 Hz, 2 Vpp input signal, R = 1K Ω.
   (i) Find out voltage waveform across the load resistor 1K
   (ii) current waveform through it.
   (iii) What is maximum voltage appearing across diode?



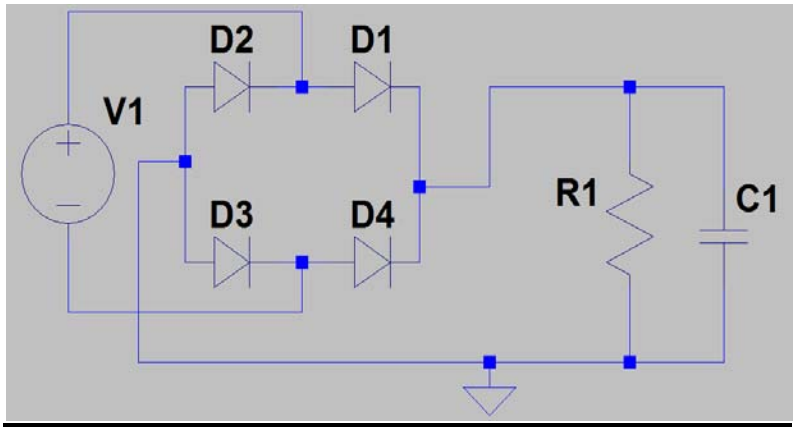
3. Perform transient simulation of the **AC-to-DC converter** with different values of resistors mentioned in components list. Compare the difference if any and explain why ? Use a 60 Hz, 2 Vpp input signal. What is the mean or average value (DC component) of voltage across the resistor R1, in all cases?



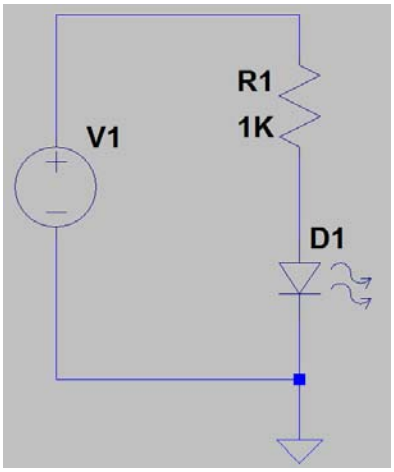
4. Perform transient simulation of the Full-Wave Rectifier circuit with the below parameters. Use a 60 Hz, 2 Vpp input signal, R = 1M Ω

   Explain how this circuit works by tracing the current paths (a) when the applied voltage is positive and (b) when it is negative.

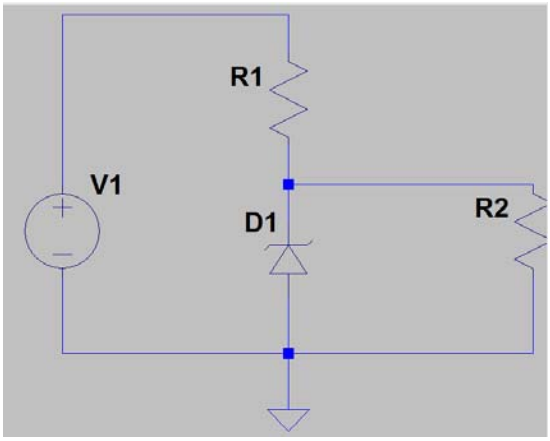
   Compare the mean voltage for this circuit to what you found for the half-wave rectifier in exercise 3. Do you see why this circuit is a better DC power supply?



5. Measure the I-V curve of a 5 mm dia standard LED to show that it is a diode. What is the highest forward voltage applied for which LED remains dark? What is the lowest voltage at which you see some light from LED?



6. Show how a zener can be used to keep a circuit safe from big voltage swings. Describe the waveform that you see across the zener. (This problem should have some quantitative inputs like input voltage 7 to 10 Volts while Zener voltage is 5.1V. If R2 = 1K (current about 5 mA) what is max value of R1 for a min Zener current of 0.5 mA? If Zener can dissipate a power of 1 watt, what is min R1 value, we can select?


R1
V1
D1
R2