College of Engineering

Electrical and Computer Engineering Department

EE-311

Lab03: PN Junction Diode Rectifier Circuits

Objectives:

To study the applications of semiconductor diodes in rectification including half-wave, full-wave, and capacitor filters.

Half-Wave Rectifier:

The conversion of AC into DC is called Rectification. Electronic devices can convert AC power into DC power with high efficiency. During the positive half cycle, the diode is forward biased and it conducts and hence a current flow through the load resistor. During the negative half-cycle, the diode is reverse-biased and it is equivalent to an open circuit, hence the current through the load resistance is zero. Thus the diode conducts only for one half-cycle and results in half wave rectification.

Half-Wave Rectifier (Circuit Diagram):

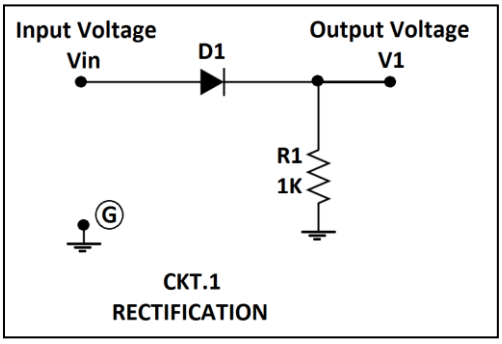


Fig. 1

Half-Wave Rectifier (DC Analysis):

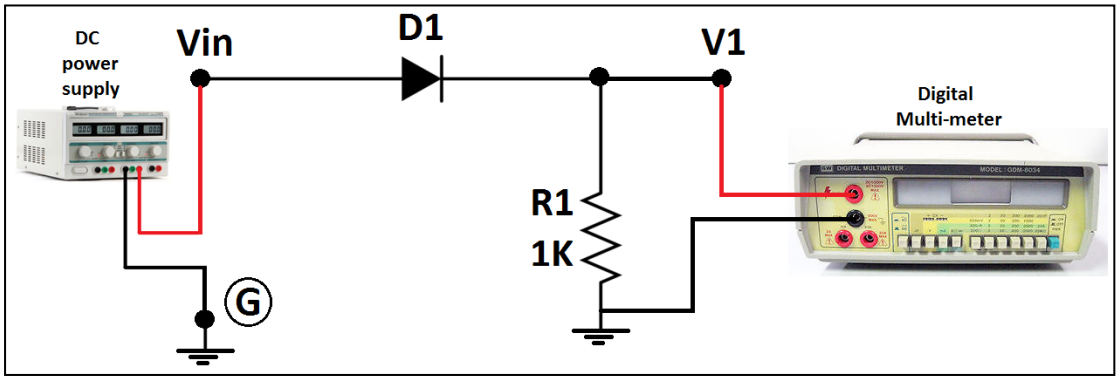


Fig.2

Half-Wave Rectifier (AC Analysis):

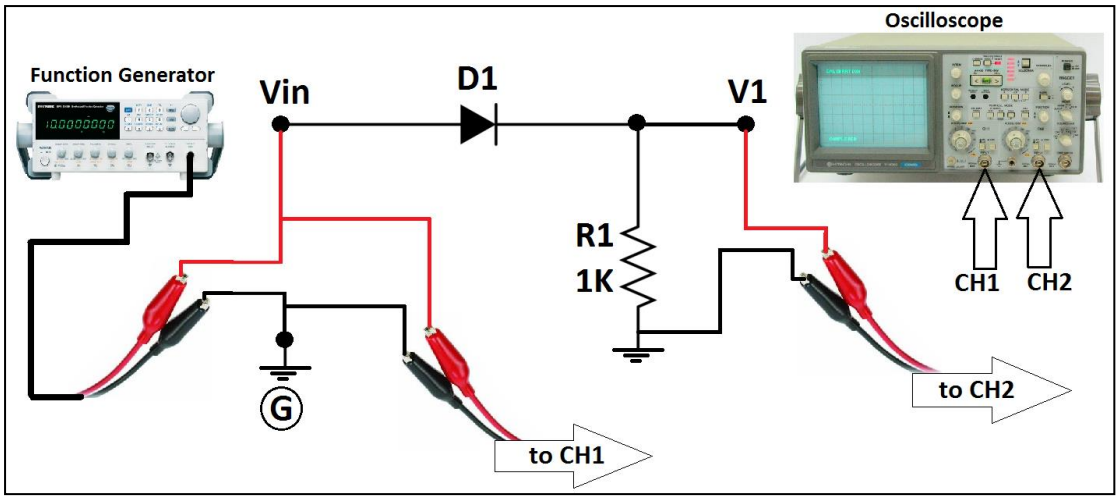


Fig. 3

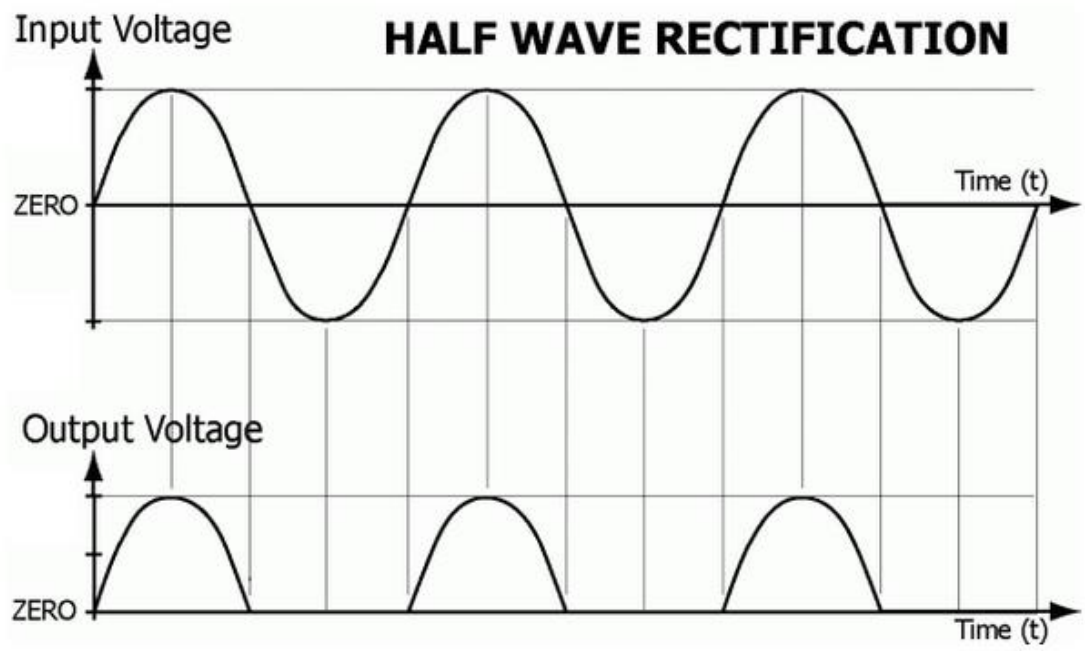


Fig. 4

Full-Wave Rectifier:

A full-wave rectifier, or a bridge rectifier, makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired and with single component bridges where the diode bridge is wired internally.

Full-Wave Rectifier (AC Analysis):

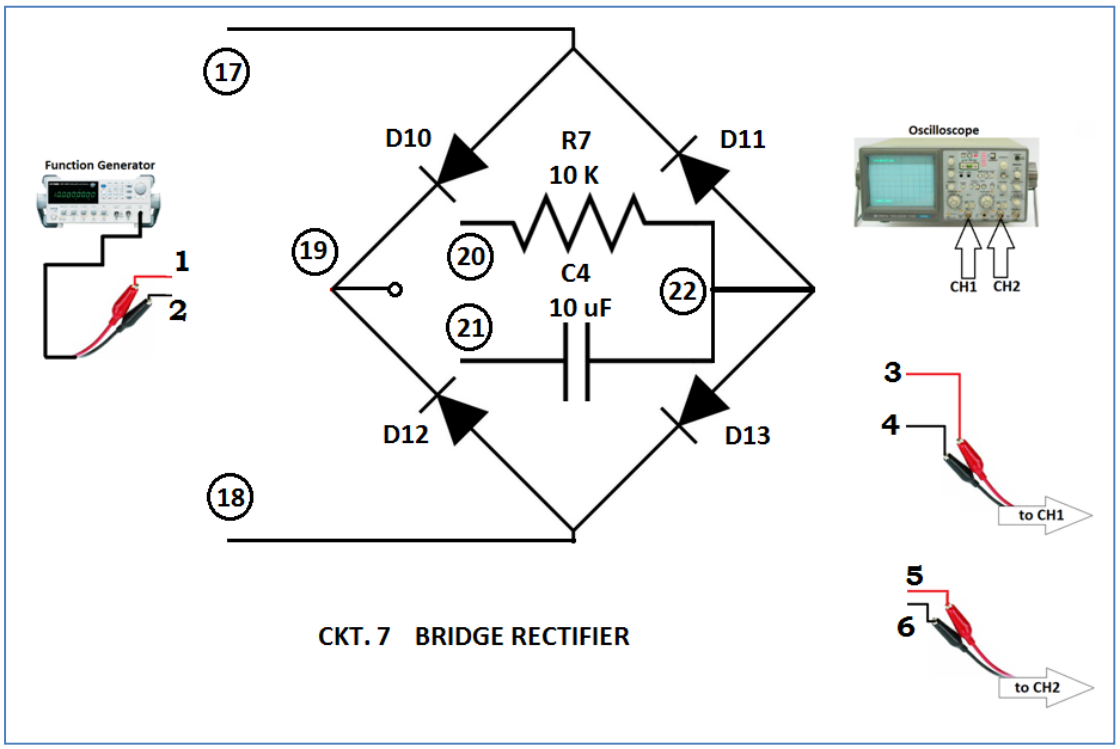


Fig. 5

LAB ACTIVITIES

Activity # 1:

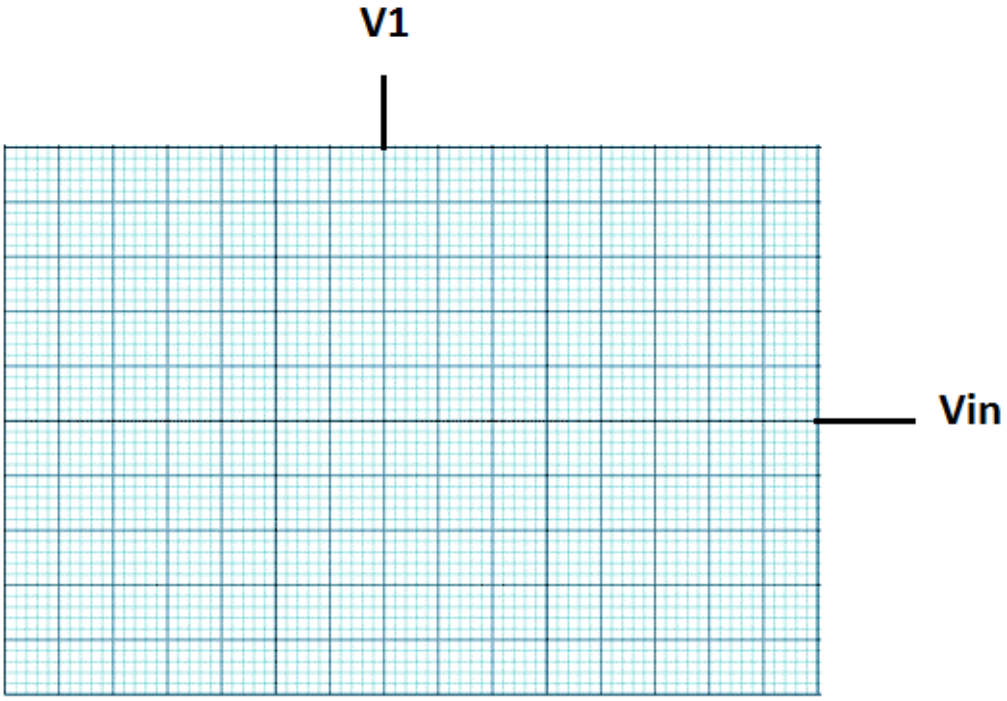
Half-Wave Rectifier (DC Analysis):

1) Connect CKT.1 as shown in Fig. 1 and Fig. 2

2) Complete the following table:

Input Voltage Vin (Volts)	Output Voltage V1 (Volts)
-5	
-4	
-3	
-2	
-1	
0	
0.1	
0.2	
0.3	
0.4	
0.5	
0.6	
0.7	
0.8	
0.9	
1	
2	
3	
4	
5	

3) Sketch Vin versus V1:



Activity # 2:

Half-Wave Rectifier (AC Analysis):

1) Connect CKT. 1 as shown in Fig. 3 and take a sinusoidal signal of 10 V peak-to-peak and a frequency of 5 kHz as an input signal.

2) Check whether you get the same output as that depicted in Fig. 4.

Activity # 3:

Full-Wave Rectifier (AC Analysis) _ (Only the resistor is connected):

1) Connect CKT. 7, which is shown on Fig. 5, as follows:

Node 1 → Node 17

Node 2 → Node 18

Node 19 → Node 20

Node 3 → Node 19

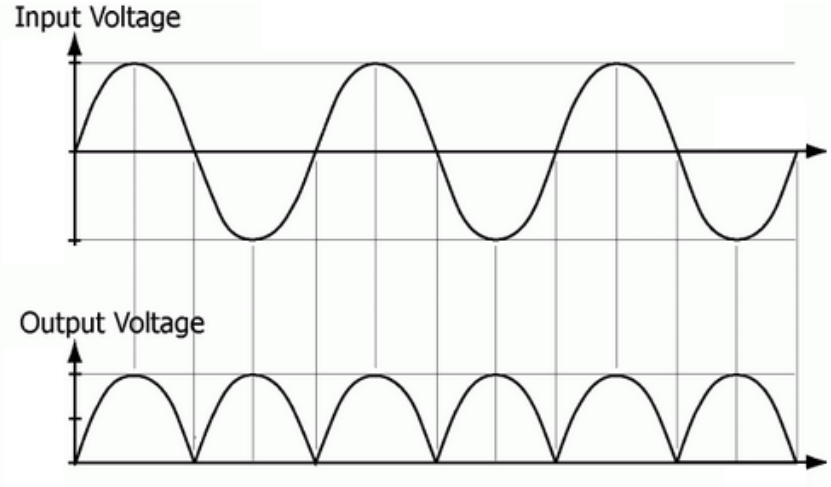
Node 4 → Node 18

Node 5 → Node 22

Node 6 → Node 18

2) Use the ADD and DC coupling of the oscilloscope to show the output.

3) Does the output look like the following figure?

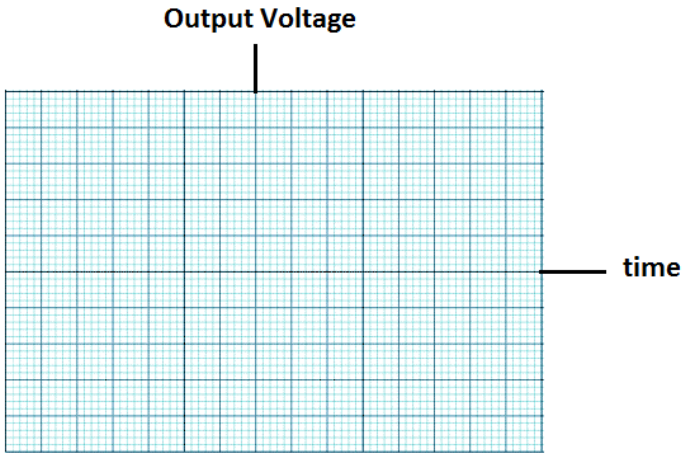


Activity # 4:

Full-Wave Rectifier (AC Analysis) _ (the resistor and capacitor are both connected):

1) Connect Node 21 → Node 19 and keep the same connection that you have done in Activity # 3.

2) Sketch the output.



Questions

Q1) What is the main application of rectification circuits?

Q2) In the half-wave rectifier circuit, does any current flow in the second half-cycle of the input voltage?

Q3) In the full-wave rectifier circuit, is the peak voltage of the output equal to the peak voltage of the input? Why?

Q4) What is the frequency of the output signal in the bridge rectifier?