

Study of Diode Rectifier Circuits

EEE-2302

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1 Objective:

To understand principle of diode in converting ac into dc and to study different diode rectifier circuits.

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3 Theory:

The diode rectifier converts the input sinusoidal voltage V_s to a uni-polar output V_o . There are two types of rectifier circuits: (i) Half-wave rectifier and (ii) Full-wave rectifier.

PIV is the peak inverse voltage that appears across the diode when it is reverse-biased. For half wave rectifier $PIV = V_m$

Ripple factor: A rectifier converts alternating currents into a unidirectional current, periodically fluctuating components still remaining in the output wave. A measure of the fluctuating component is given by the ripple factor r , which is defined as $r = \text{RMS value of alternating components of wave} / \text{Average value of wave}$ For a half-wave rectifier, $r = 1.21$ and for a full wave rectifier $r = 0.482$

Filter: The rectifier with a filter is shown in Fig 1. When capacitor charges to V_p (12V p-p), input voltage decreases immediately but capacitor will not charge its voltage instantaneously. As a result diode will be reverse biased and stop conducting. The stored charges on the capacitor will be released through R.

4 Equipments:

Trainer board
Multimeter
Resistor
Capacitor 1 μ F, 47 μ F, 220 μ F, 1000 μ F
Diode 4 pieces

5 Circuit Diagram:

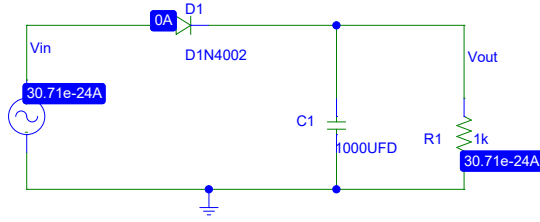


Figure 1: Circuit diagram for half-wave rectifier.

The input and output of the rectifier are drawn in fig. 1. Diode conducts only when it is forward biased. For $V_s = V_m \sin \omega t$, DC voltage of a half wave rectifier is $V_{DC} = (V_m - V_T)/\pi$; where $V_T \approx 0.7$

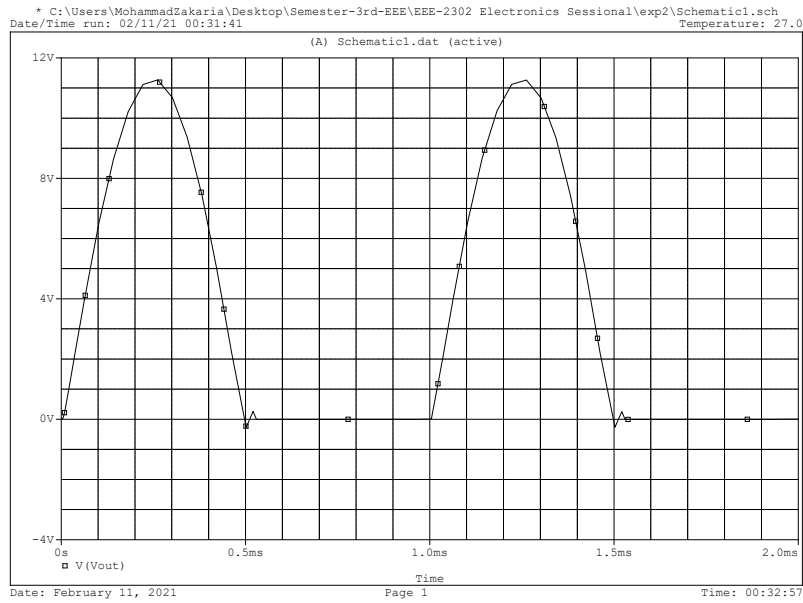


Figure 2:
Output voltage, when no capacitor is connected. Output is pulsating dc.

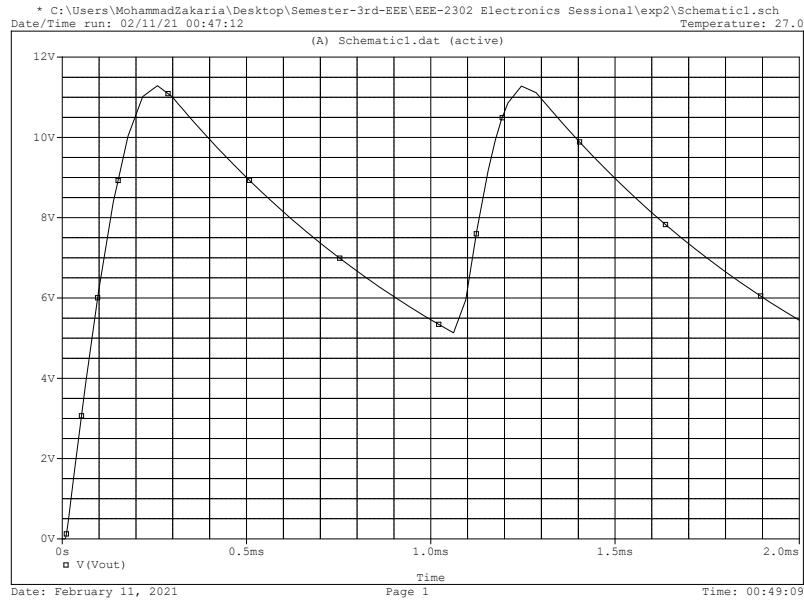


Figure 3:
Output voltage when $1\mu\text{F}$ capacitor is connected in parallel with the load. Ripple is decreasing, still this is not pure dc.

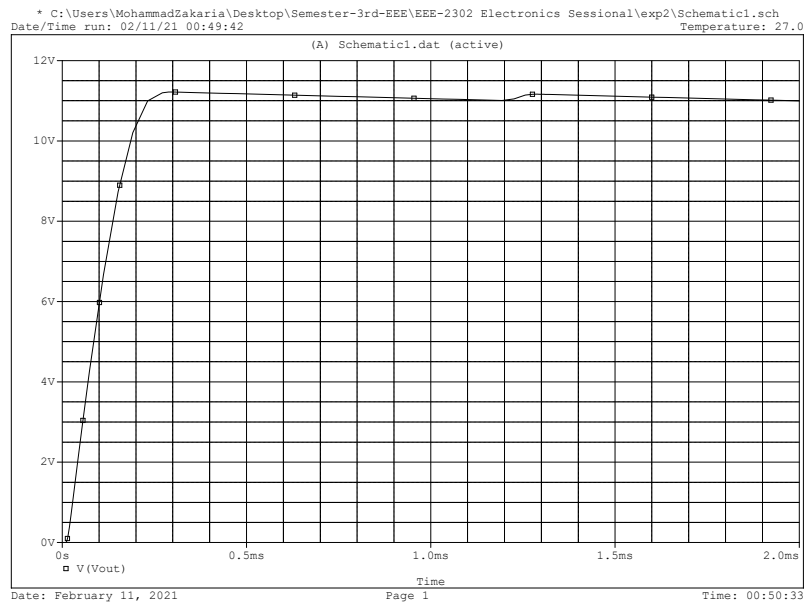


Figure 4:
This is almost nearer to pure dc.

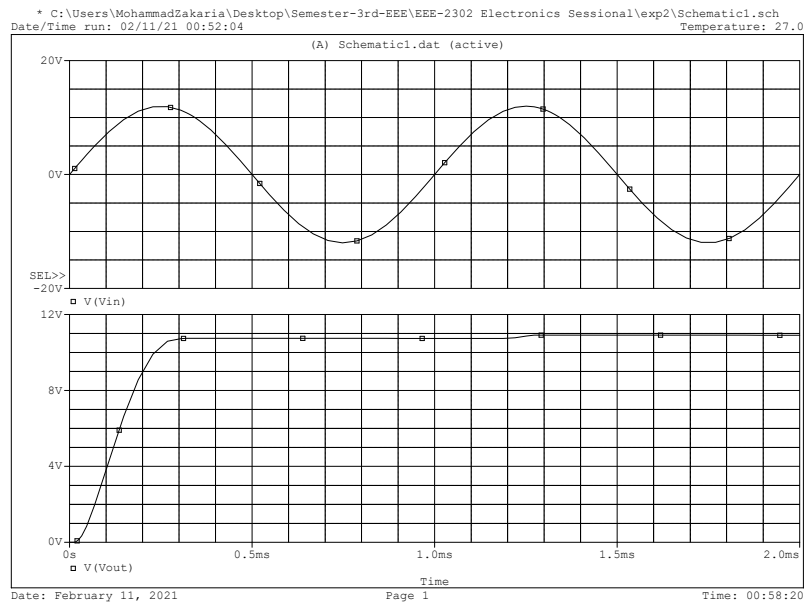


Figure 5:
Input and output voltage curve for half-wave rectifier. Here we connected $220\mu\text{F}$ capacitor. From the simulation graph the output seems to pure dc.

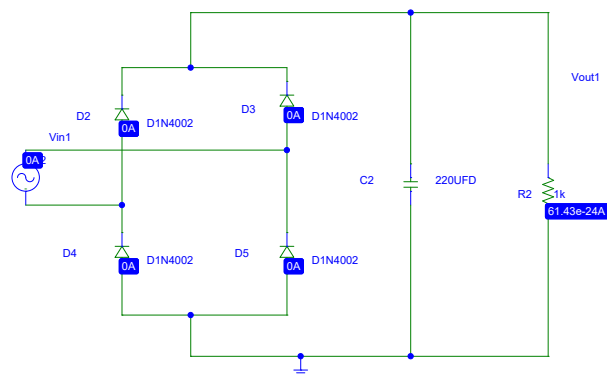


Figure 6: Circuit diagram for bridge rectifier.

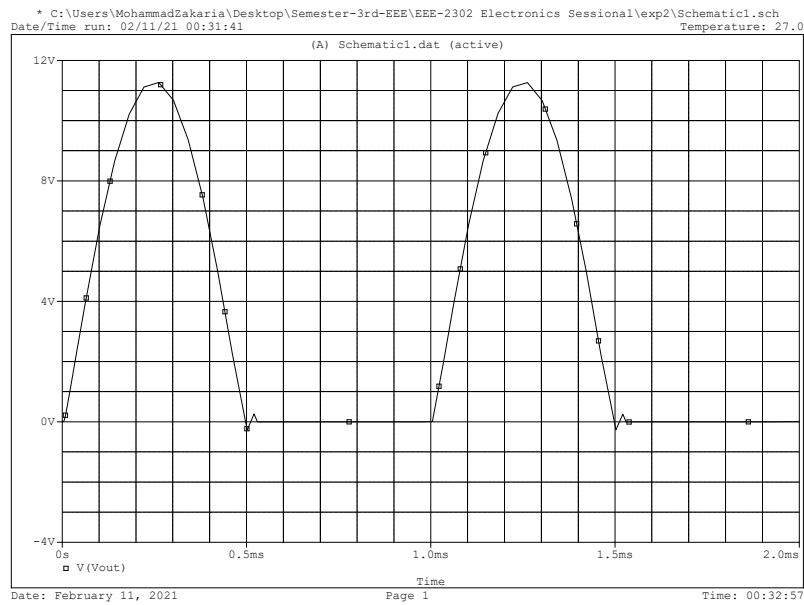


Figure 7:
 Output voltage for full wave bridge rectifier when no capacitor is connected.

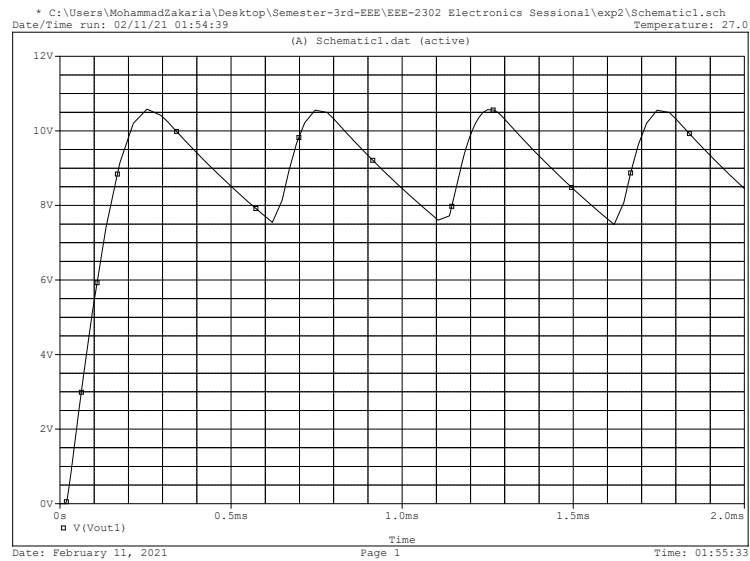


Figure 8:
 Output voltage curve, when 1 μF capacitor is connected in parallel with the load.

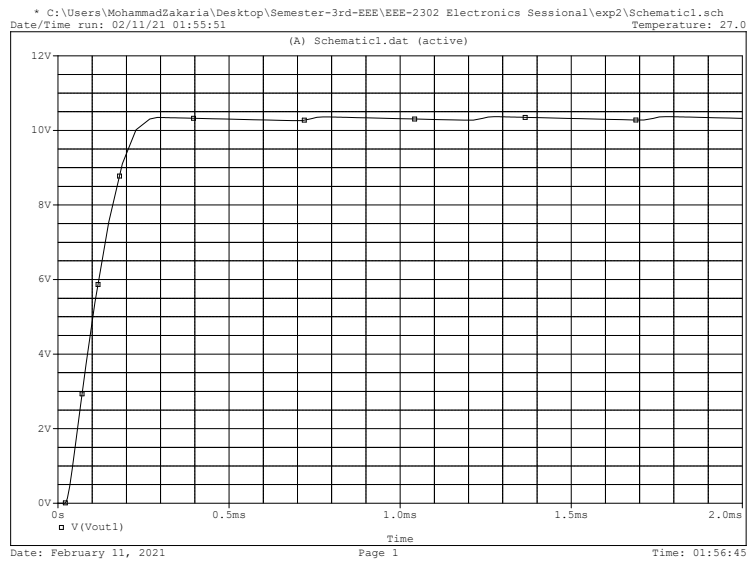


Figure 9:
Output voltage curve, when 47 μF capacitor is connected in parallel with the load.

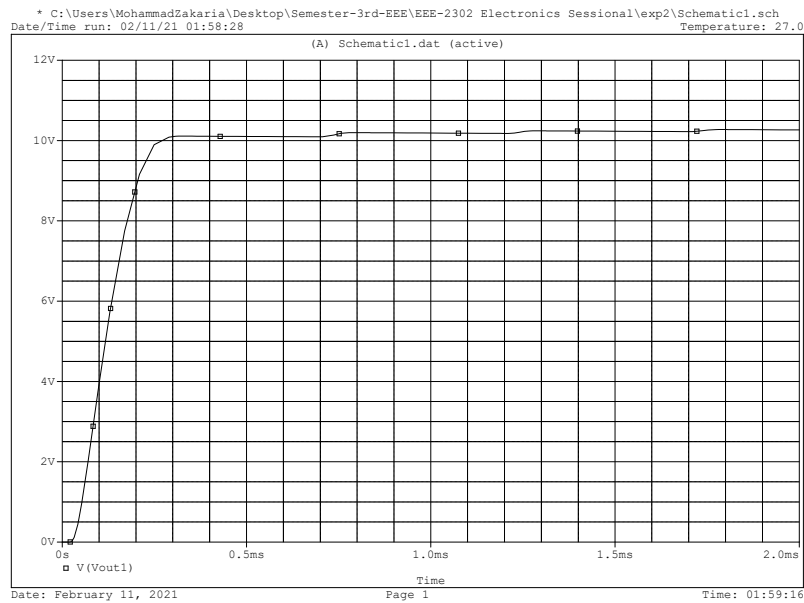


Figure 10:
Output voltage for full wave bridge rectifier when 220 μF capacitor is connected.