Rectifiers

1.

The input of a full-wave rectifier is a cosine voltage with peak V_M = 5 V and frequency 60 Hz, and output load resistance is R = 2 kΩ. Silicon diodes are used in this circuit for which the forward drop is V_{D0} = 0.7 V.

(a) Briefly explain the purpose of a rectifier and describe its operation.
(b) Show the input and output waveforms.
(c) Calculate the DC value of the output voltage.
Now after connecting a capacitor in parallel with the load, the output becomes a ripple voltage **Vout** = V_{DC} **±0.2 V**
(d) Calculate the **peak-to-peak ripple voltage**, and from that, the value of the capacitor.
(e) Calculate the average of the output voltage V_{DC} after connecting the capacitor. Compare this with the DC value determined in 'c' and comment on the difference between these two.

2.

The input of a **Half-wave rectifie**r is a sine voltage with peak VM = 10 V and frequency 55 Hz, and output load resistance is R = 2.5 kΩ. Silicon diodes are used in this circuit for which the forward drop is V_{D0} = 0.4 V.

(a) Calculate the DC value of the output voltage.
Now after connecting a capacitor in parallel with the load, the output becomes a ripple voltage **Vout** = V_{DC} **±0 V.**
(d) Calculate the **peak-to-peak ripple voltage**, and from that, the value of the capacitor.
(e) Calculate the average of the output voltage V_{DC} after connecting the capacitor. Compare this with the DC value determined in 'c' and comment on the difference between these two.
(f) Draw the **Voltage Transfer Characteristic (VTC) curve**

3.

The input of a full-wave rectifier is expressed by, Vs(t)= 7sin(400πt), and output load resistance is R = 5 kΩ. Silicon diodes are used in this circuit for which the forward drop is V_{D0} = 0.3 V.

(a) Calculate the input and output wave frequency.
(b) Show the input and output waveforms.
(c) Calculate the DC value of the output voltage.

Now after connecting a capacitor, C= 100 μF in parallel with the load.

(d) Calculate the peak-to-peak ripple voltage,
(e) Calculate the average of the output voltage V_{DC}after connecting the capacitor. Compare this with the DC value determined in 'c' and comment on the difference between these two.
(f) How can you provide better filtering for the output waves?
(g) What is the frequency of the Ripple voltage?

4.

The input of a **Half-wave rectifier** is a **Square** wave voltage with peak V_M= 15 V and frequency 0.5 Hz, and output load resistance is R = 5 kΩ. Silicon diodes are used in this circuit for which the forward drop is V_{D0} = 0.7 V.

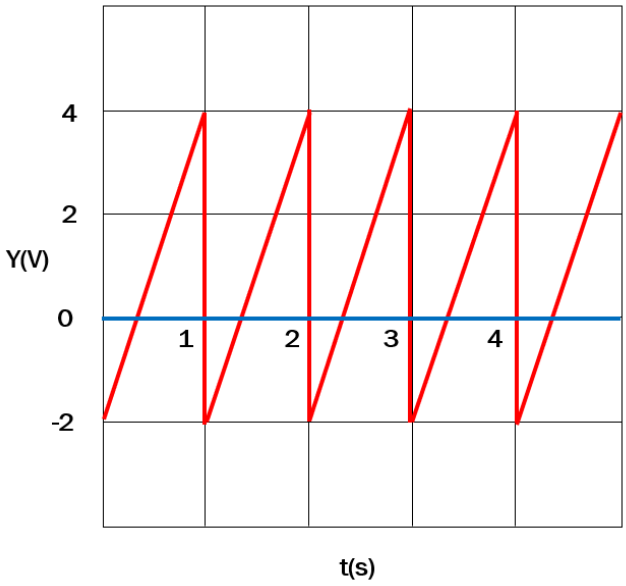
i. Show the input and output waveforms.
ii. Draw the VTC curve

5.

The input of a **full-wave rectifier** is a **Square** wave voltage with peak V_M= 15 V and frequency 0.5 Hz, and output load resistance is R = 5 kΩ. Silicon diodes are used in this circuit for which the forward drop is V_{D0} = 0.7 V.

i. Show the input and output waveforms.
ii. Draw the VTC curve

6.



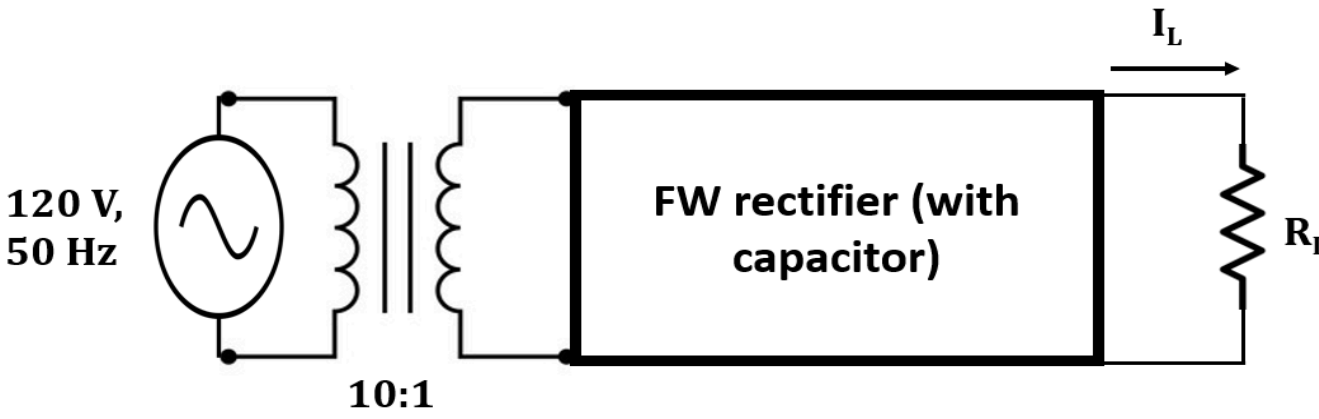
The input of a Half-wave rectifier is exhibited in the Figure above and output load resistance is R = 5 kΩ. Silicon diodes are used in this circuit for which the forward drop is V_{D0} = 0.7 V.

i. Show the input and output waveforms.

ii. Draw the VTC curve

7.

A full-wave rectifier is designed to deliver a maximum current I_L = 120 mA to the load. The rectifier produces an output with a ripple of 5% of the peak output voltage. An input line voltage of 120 V (peak), 50 Hz is available. A 10:1 step-down transformer is used to transform the supply voltage to 12 V (peak).



(a) Draw the Voltage Transfer Characteristics of the full-wave rectifier. [2]
(b) Calculate the peak output voltage. [1]
(c) Determine the value of the Load Resistor to deliver a maximum load current of 120mA. [2]
(d) Deduce the value of the Capacitor and the DC average value. [1]
(e) Assume the transformer is removed and the rectifier is directly connected to the AC power supply line. Discuss the state of the diodes. [Hint: use the Peak Input Value of the rectifier input] [3]