Assignment 3
CSE251
Summer-25
Total Marks: 100

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} **±0.3 V.**

   (b) Calculate the **peak-to-peak ripple voltage**, and from that, the value of the capacitor.
   (c) 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.

   Now after connecting a capacitor, C= 100 μF in parallel with the load.
   (c) Calculate the peak-to-peak ripple voltage,
   (d) How can you provide better filtering for the output waves?
   (e) 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

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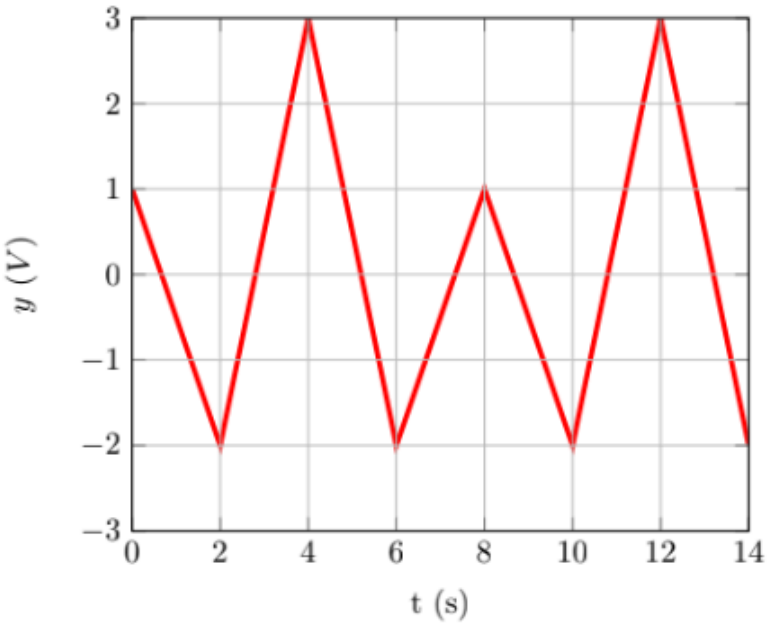
5. The input of a **full-wave rectifier** is a **Square** wave voltage with peak V_M = 15 V and frequency 0.5 Hz, and output load resistance is R = 5 kΩ. Silicon diodes are used in this circuit for which the forward drop is V_{D0} = 0.7 V.

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

6.



(b) Input of the FW rectifier

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Part 2: A voltage waveform $V_i = 15\sin(2000\pi t)$ V is fed into a Half-wave rectifier with a load resistance $R = 5$ kΩ. Silicon diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.7$ V.

(a) **Illustrate** the input and output waveforms in separate graphs. Label the graph and **indicate** the voltage levels properly. [2]

(b) **Calculate** the DC/Average value of the output. [1]

(c) A capacitor is now added to reduce the fluctuation of the output voltage, which makes the peak to peak ripple voltage **4%** of the maximum output voltage V_P. **Deduce** is the value of the capacitor from the given data.[2]

(d) The input of a Full-wave rectifier is shown in Figure 1(b) above and output load resistance is $R = 10$ kΩ. Germanium diodes are used in this circuit for which the forward drop is $V_{D_0} = 0.3$ V. **Show** the input and output waveforms [1]

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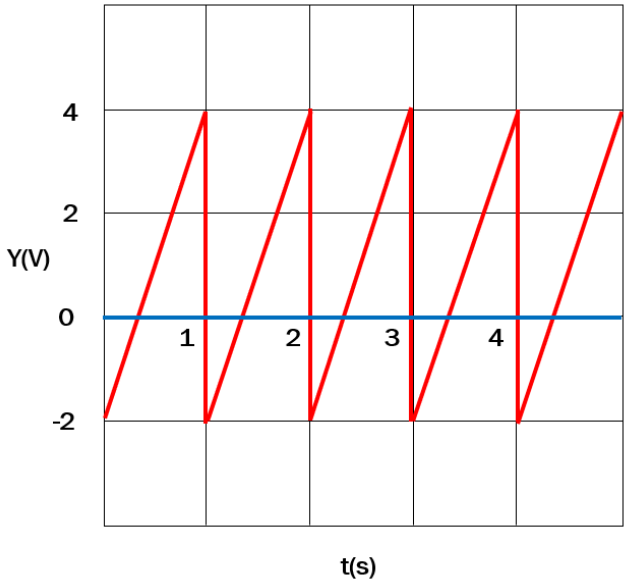
7.



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
Iii. Calculate input and output frequency

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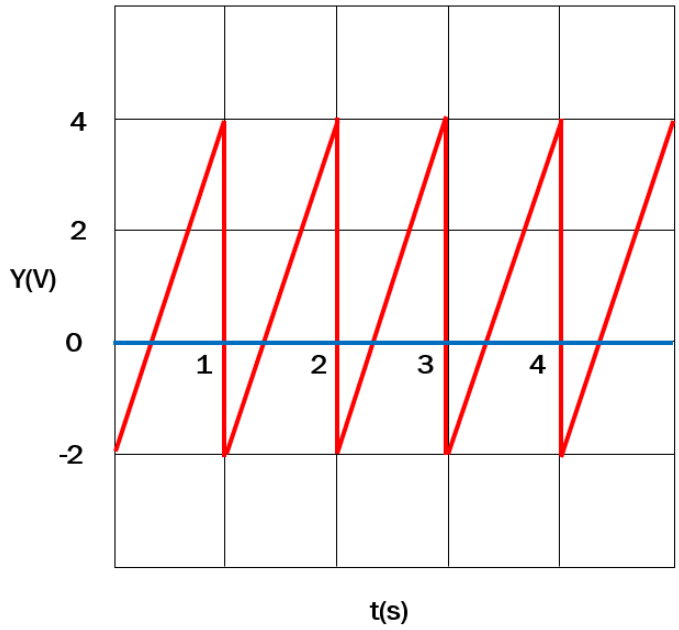

8. The input of a **full-wave rectifier** is exhibited in the Figure above and output load resistance is R = 5 kΩ. Silicon diodes are used in this circuit for which the forward drop is V_{D0} = 0.7 V.

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

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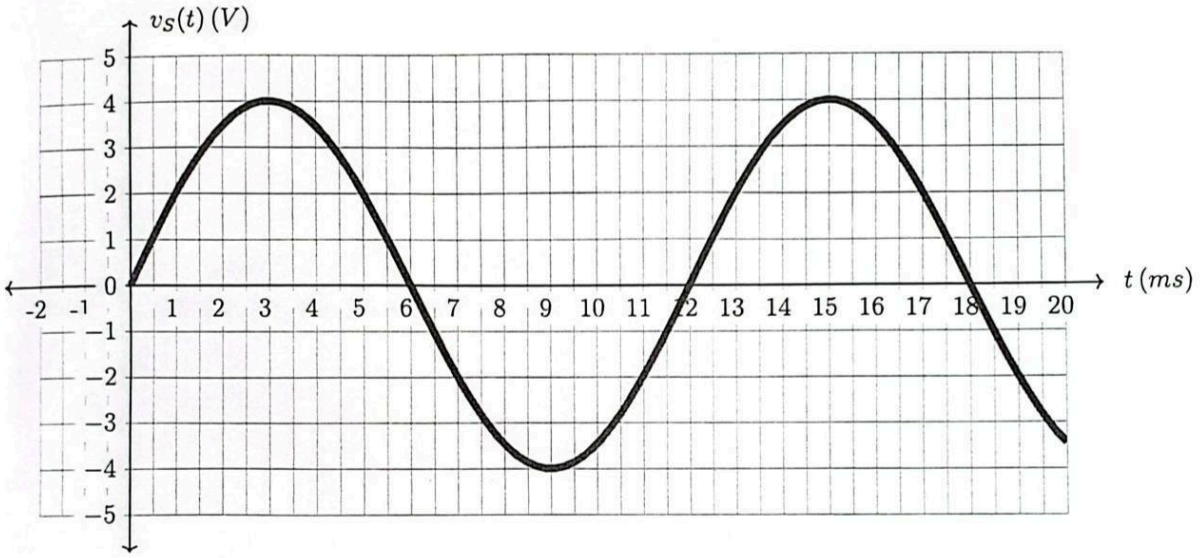
9. $v_S(t)$ is the input voltage to a half wave rectifier without filter capacitor.



(a) *[4 marks]* Assuming a cut-in voltage of 1 V for the diode used in the rectifier, approximately draw the output voltage waveform on the same grid.

(b) *[2 marks]* Determine the *approximate* average of the output voltage, V_{avg} or V_{DC}.

(c) *[2 marks]* Determine the fraction of time within a cycle the diode is conducting.

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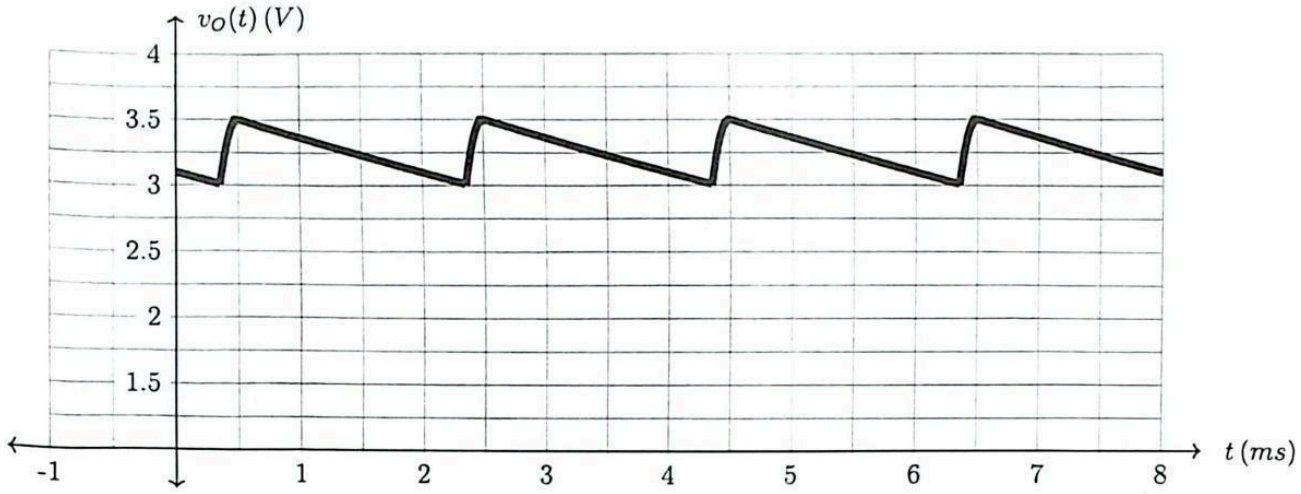
10.

$v_O(t)$ is the rectified output of an ac sinusoidal voltage $v_S(t)$ at 250 Hz frequency, provided to a load of 4.5 kΩ. The diode(s) used in the rectifier had a cut-in voltage equal to 0.5 V.



(a) *[2 marks]* Which rectifier was used to rectify the sinusoidal voltage? Explain in brief.

(b) *[4 marks]* Determine the capacitance used in the rectifier's design.

(c) *[2 marks]* Write an expression of the input voltage as a function of time.

(d) *[4 marks]* Draw the circuit diagram of the rectifier. Label the input $v_S(t)$ and output $v_O(t)$ voltages properly on the circuit diagram.