EE 101 Tutorial 2 — 28/11/2022.

Q1. Given,

$$f_{in} = 60\,Hz, \quad v_R = 300\,mV$$

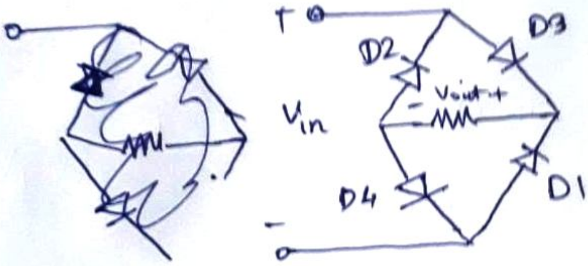
and $I_L = 0.5\,A$.

$$\therefore \; v_R = \frac{I_L}{C_1 f_{in}} \leq 300\,mV$$

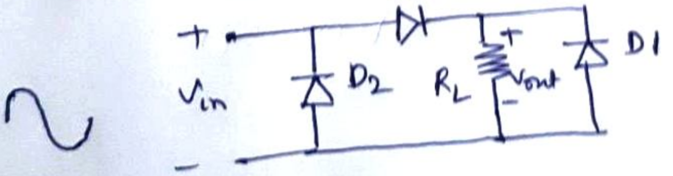
$$C_1 \geq \frac{I_L}{(300\,mV)\, f_{in}}$$

$$\text{or } C_1 = 27.78\,mF.$$

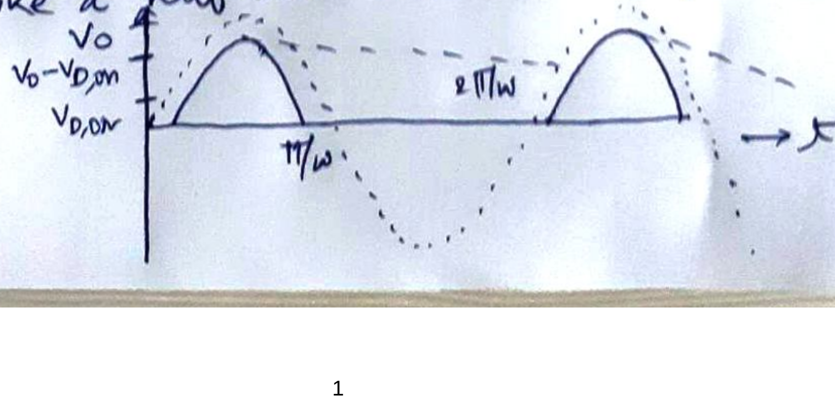
Q2. A full wave circuit is given as



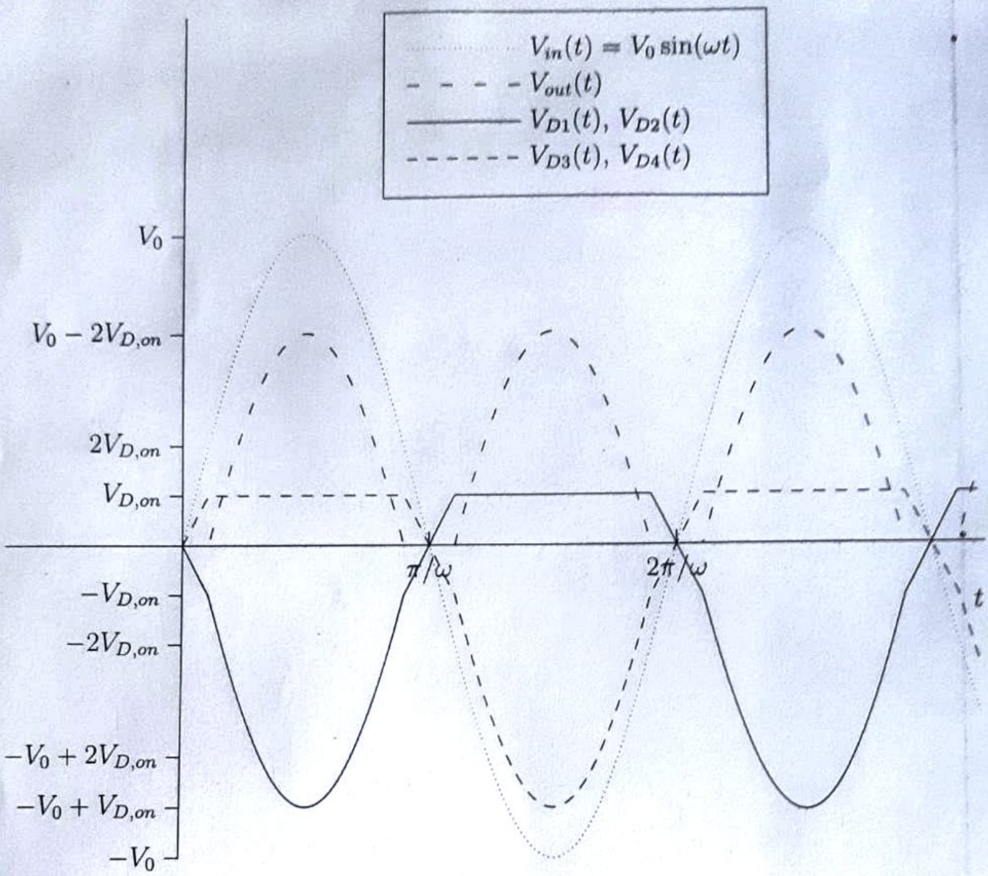
Now, shorting the input and output grounds of a full-wave rectifier removes the D4 diode. Redrawing gives us,



During the +ve half cycle, D_3 turns on and forms a half-wave rectifier along with R_L. On negative half cycle, D_2 shorts the input and thus the output remains at 0. Thus the circuit behaves like a half-wave rectifier. The plots of Vout are -



Q3 ~~2.49~~ Note that the waveforms for V_{D1} and V_{D2} are identical, as are the waveforms for V_{D3} and V_{D4}.



Q4 During the positive half cycle, D_2 and D_3 will remain reverse-biased, causing V_{out} to be 0 as no current will flow through R_L.

During the negative half cycle, D_1 and D_3 will short the input and thus R_L will have 0 current flowing through it -

Thus V_{out} will always remain 0 and the circuit will fail to act as rectifier.

Q5

$V_{D_{ON}} = 800\,mV = 0.8\,V$

$C = 1000\,\mu F = 10^{-3}\,F$

$V_o = 3V$

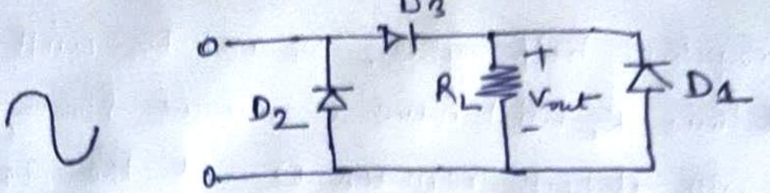
$R = 30\Omega$, $f_{in} = 60\,Hz$.

$$V_R = \frac{1}{2} \frac{V_o - 2 \cdot V_{D_{ON}}}{R C f_{in}}$$

$$= \frac{1}{2} \frac{3 - 2 \times 0.8}{30 \times 10^{-3} \times 60}$$

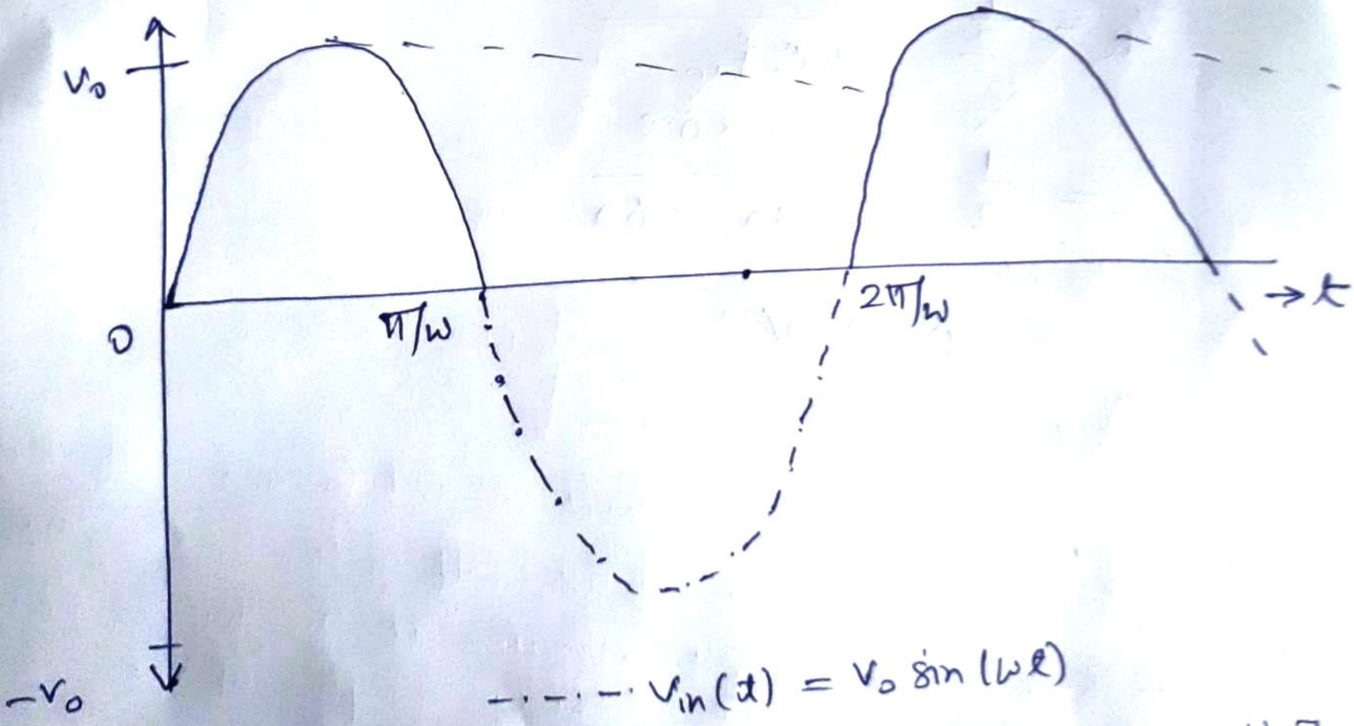
$$= 0.389\,V$$

Q6 Shorting the negative terminals of V_{in} and V_{out} of a full-wave rectifier shorts out the Diode D_4 from the circuit of full wave rectifier. Redrawing the circuit



On positive half cycle, D_3 turns on and forms a half wave rectifier along with R_L.

~~one~~ On negative half cycle, D_2 shorts the input and the output remains at 0. Thus the circuit behaves like half-wave rectifier. The plots of $V_{out}(t)$ are shown below.



-·-·-· $V_{in}(t) = V_0 \sin(\omega t)$

——— $V_{out}(t)$ [without load capacitor]

- - - - $V_{out}(t)$ [with load capacitor].