CSE 251

Assignment - 02

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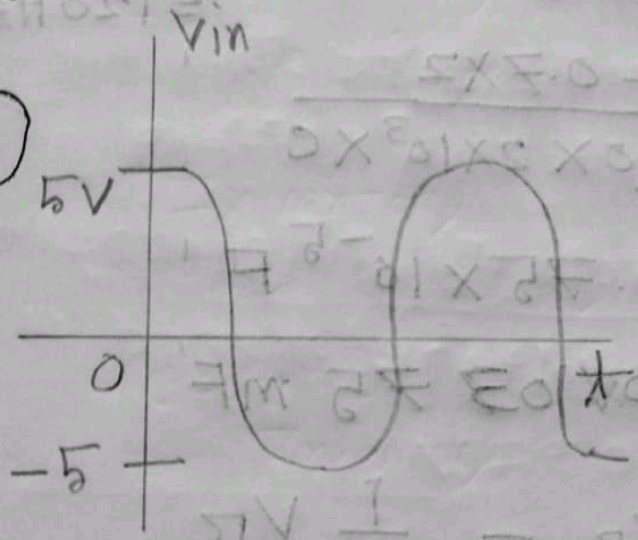
Section: 03

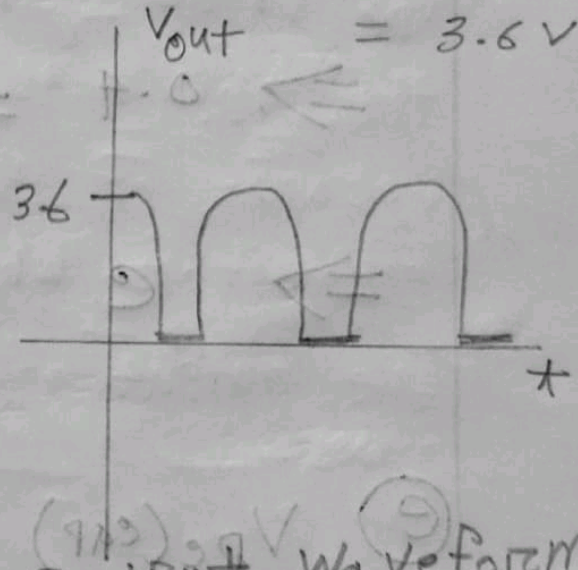
1. (a) We use rectifier circuit to convert AC signals into DC signals. We use diode in the rectifier circuit which allows the current to flow in one direction which actually convert AC signal into pulsating DC.

$V_P = 5 - 2 \times 0.7$
$= 3.6\,V$

(b)



Input wave form



output waveform

(c) $V_{DC} = \frac{2V_M}{\pi} - 2V_D$

$= \frac{2}{\pi} 5 - 2 \times 0.7$

$= 1.78\,V$

(d) $V_r = (V_c + 0.2) - (V_c - 0.2)$

$= 0.4V$

we know,

$$V_r = \frac{V_P}{f_r RC}$$

$f_r = 2f_i$

$= 2 \times 60\ Hz$

$= 120\ Hz$

$$\Rightarrow 0.4 = \frac{5 - 0.7 \times 2}{120 \times 2 \times 10^3 \times C}$$

$$\Rightarrow C = 3.75 \times 10^{-5} F$$

$$= 0.0375\ mF$$

(e) $V_{DC(cap)} = V_P - \frac{1}{2} V_r$

$= (5 - 0.7 \times 2) - \frac{1}{2} \times 0.4$

$= 3.4V$

After connecting ~~connecting~~ the capacitor the V_{DC} value increased compared to the V_{DC} value without capacitor. It is because when the the voltage source is not maximum

it discharges, which is actually the smoothing effect of a capacitor in a rectifier.

(2) (a) $V_M = 10V$, $f_i = 55\,Hz$,

$R = 2.5\,K\Omega$, $V_{D_0} = 0.4V$

(a) $V_{DC} = \frac{V_M}{\pi} - \frac{1}{2}V_{D_0}$

$= \frac{10}{\pi} - \frac{1}{2} \times 0.4$

$\simeq 2.98V$

(b) $V_r = (V_{DC} + 0) - (V_{DC} - 0)$

$= 0$

(4)

$f_r = f_i$

$= 55\,Hz$

$V_r = \frac{V_P}{f_r R C}$

$\Rightarrow 0 = \frac{V_P}{55 \times 2.5 \times 10^3 \times C}$

$\Rightarrow C = \infty$ (infinite)

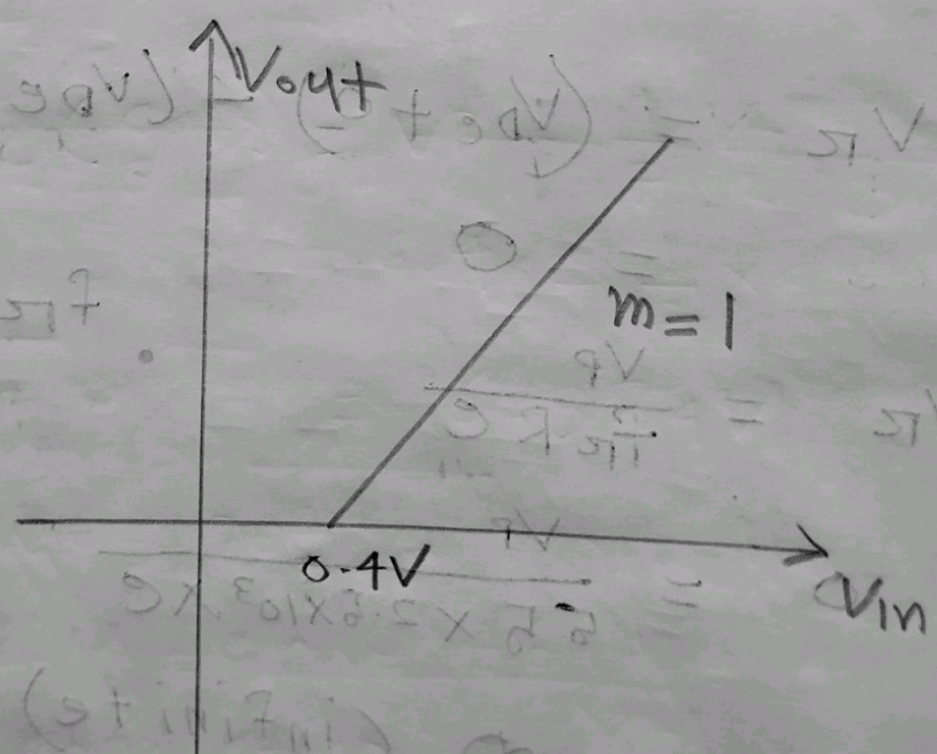
(e) $V_{DC}(cap) = V_P - \frac{1}{2} V_r$

$= (10 - 0.4) - \frac{1}{2} \times 0$

$= 9.6V$

After connecting the capacitor the V_{DC} value increased compared to the V_{DC} without capacitor. This happened because of the smoothing effect of capacitor which actually discharges when the output of the voltage source is not max.

(f)



③ $V_s(t) = 7\sin(400\pi t)$, Full wave

$R = 5K\Omega$

$V_M = 7V$

$V_{D0} = 0.3V$

$f_i = \frac{400}{2} = 200Hz$

$V_P = 7 - 2\times 0.3$

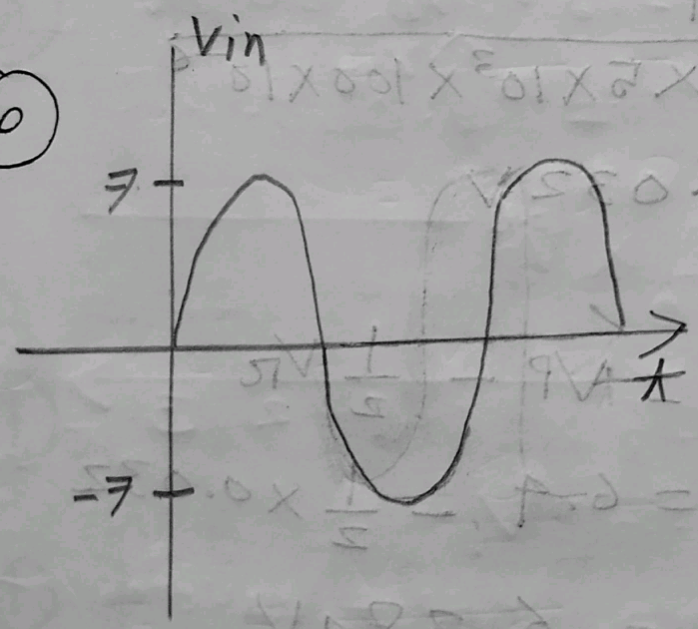
$= 6.4V$

ⓐ $f_i = \frac{400}{2} = 200Hz$, $f_R = 2f_i$

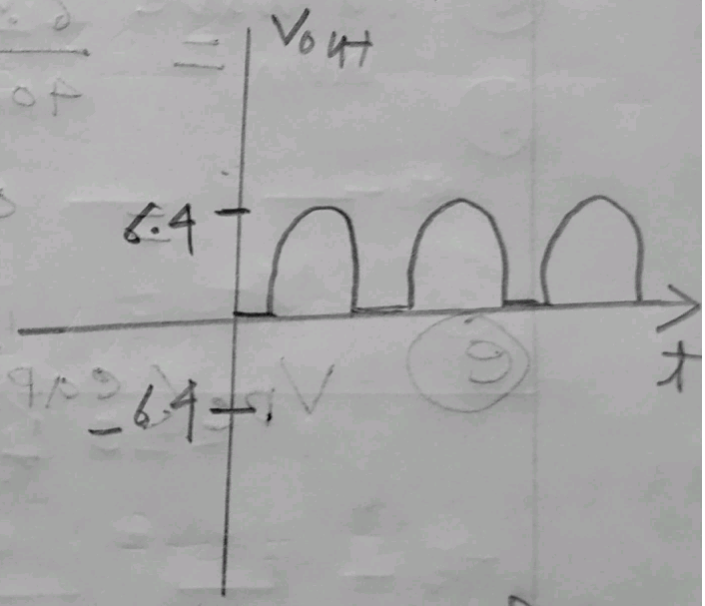
$= 2\times 200Hz$

$= 400Hz$

ⓑ



input waveform



output waveform

(c) $V_{DC} = \frac{2}{\pi} \times V_M - 2V_{D_0}$

$= \frac{2}{\pi} \times 7 - 2 \times 0.3$

$= 3.85V$

(d) $C = 100\mu F$

$V_r = \frac{V_P}{f_r RC}$

$= \frac{6.4}{400 \times 5 \times 10^3 \times 100 \times 10^{-6}}$

$= 0.032V$

(e) $V_{DC}(cap) = V_P - \frac{1}{2} V_r$

$= 6.4 - \frac{1}{2} \times 0.032$

$= 6.384V$

Here we get a higher V_{DC} value and it is close to the peak voltage after connecting the capacitor. It happenned because of capacitor's

smoothing effect. Discharging nature helps to achieve this effect.

(f) For better filtering of output waves, a capacitor with higher capacitance can be used.

(g) $f_r = 2f_i$

$= 2 \times 200$

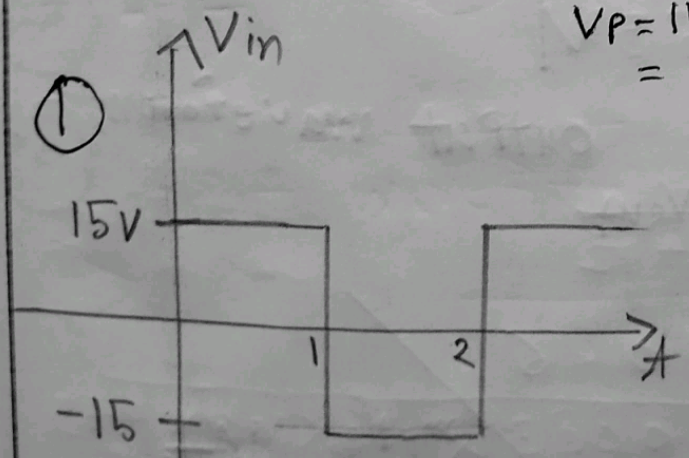
$= 400\,Hz$

(4) $V_M = 15V$, $f_i = 0.5\,Hz$, $R = 5\,k\Omega$

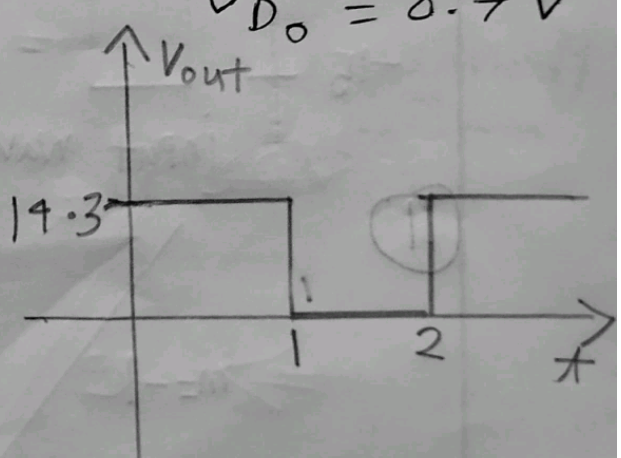
$V_{D_0} = 0.7V$

$V_P = 15 - 0.7V$
$= 14.3V$

(1)

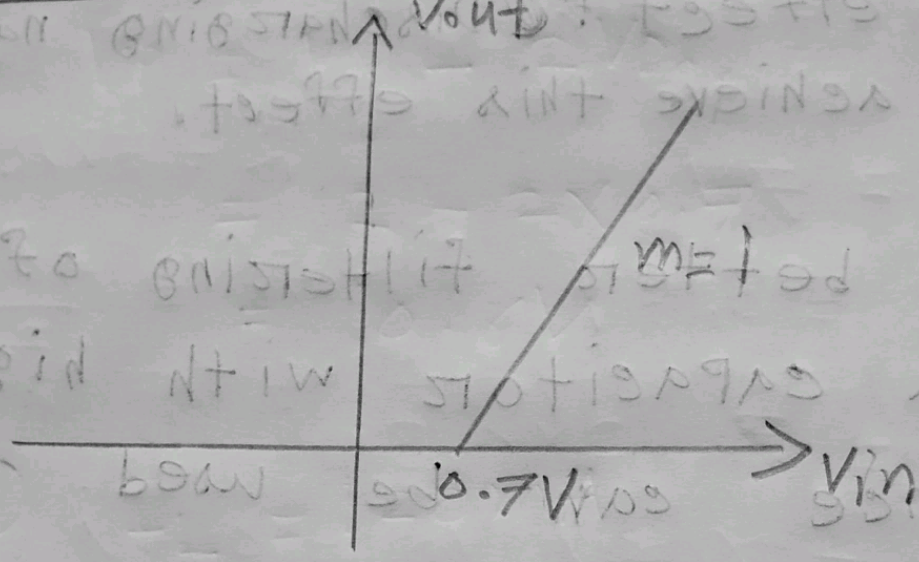


input waveform



output waveform

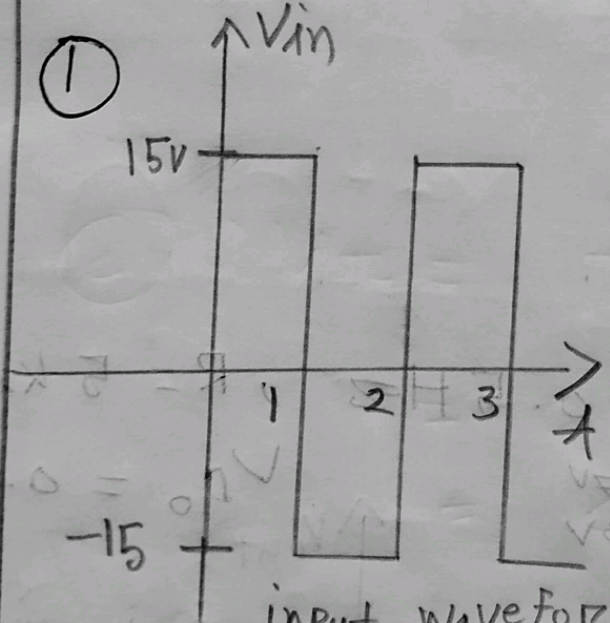
(II)



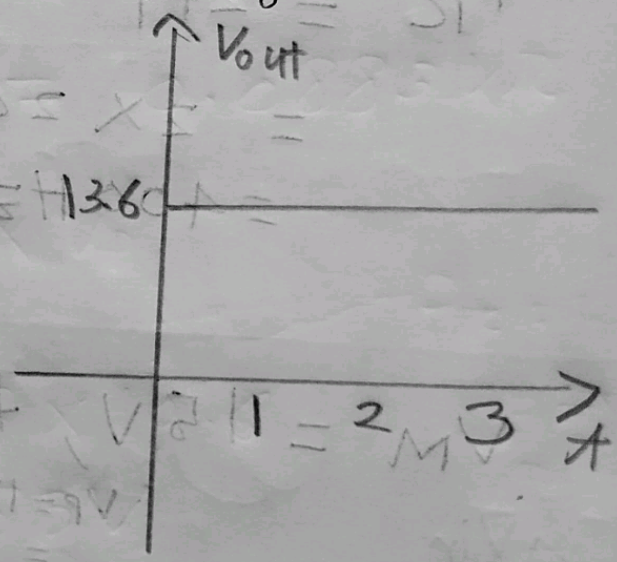
VTC

(b) Fullwave , $V_M = 15V$, $V_{D_0} = 0.7V$

(I)

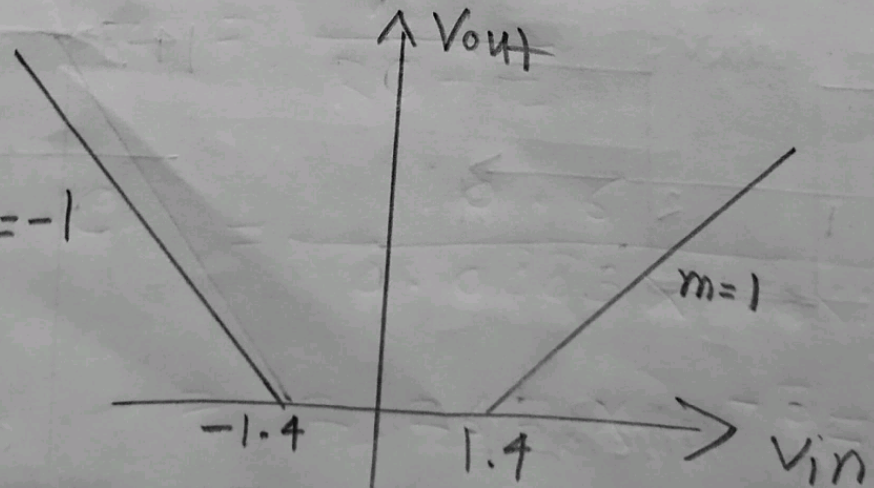


input waveform



output waveform

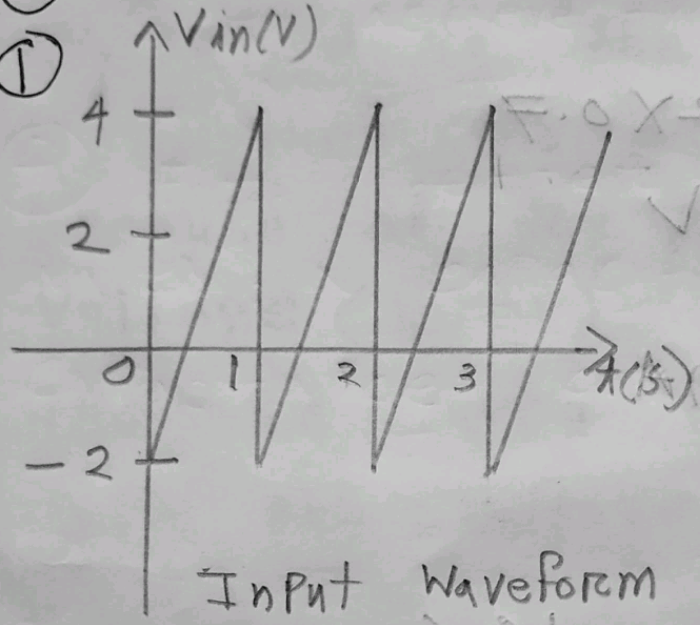
(II)



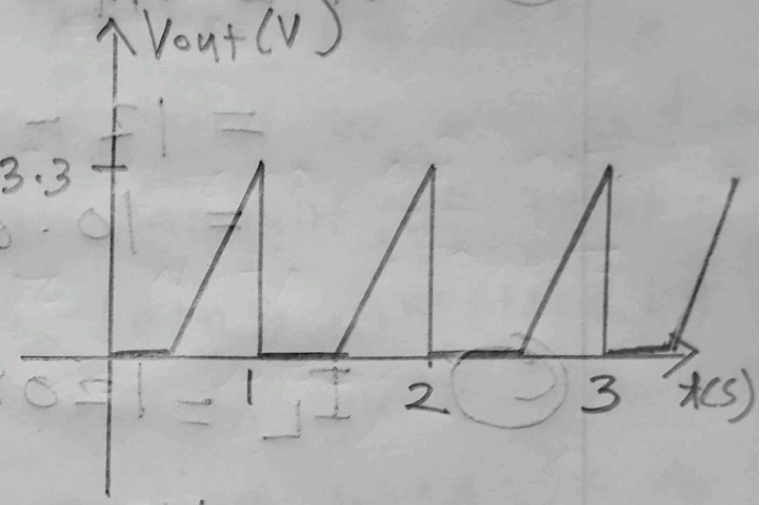
VTC

⑥ Half wave, $R = 5K\Omega$, $V_{D_0} = 0.7V$

(I)

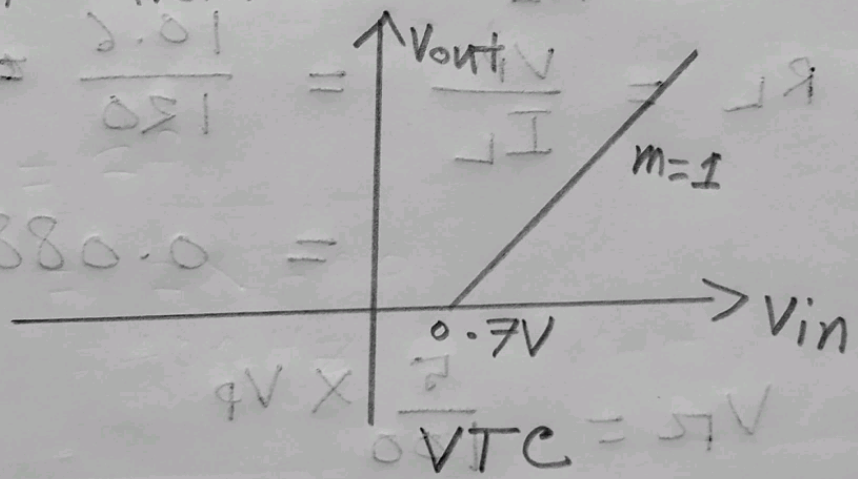


Input Waveform



output Waveform

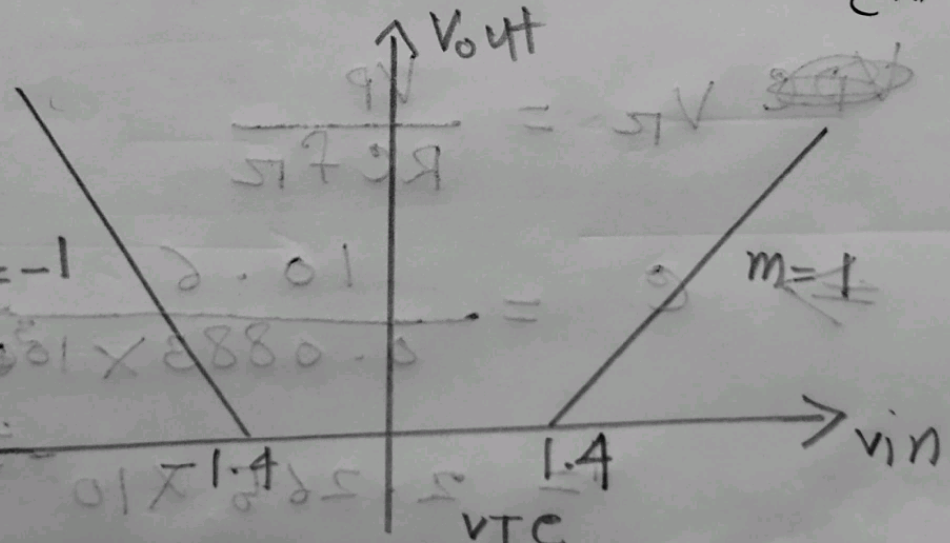
(II)



VTC

⑦ F.W, $V_M = 12V$, $f_i = 50Hz$, $V_{D_0} = 0.7V$ (Assumed)

(I)



VTC

(b) $V_P = V_M - 2V_{D_0}$

$= 12 - 2 \times 0.7$

$= 10.6V$

(c) $I_L = 120mA$

$I_L = \frac{V_P}{R_L}$

$\Rightarrow R_L = \frac{V_P}{I_L} = \frac{10.6}{120}$

$= 0.0883 k\Omega$

(d) $V_r = \frac{5}{100} \times V_P$

$= 0.05 \times 10.6$

$= 0.53V$

$f_r = 2 \times f_i$

$= 2 \times 50$

$= 100Hz$

$V_r = \frac{V_P}{RCf_r}$

$\Rightarrow C = \frac{10.6}{0.0883 \times 10^3 \times 100 \times 0.53}$

$= 2.265 \times 10^{-3} F$

(e) If the rectifier is directly connected to the AC power supply line, then the diodes will be damaged because a ~~the~~ huge amount of input voltage (120V) is being supplied by the AC supply which is much higher than the voltage rating used in the diodes.