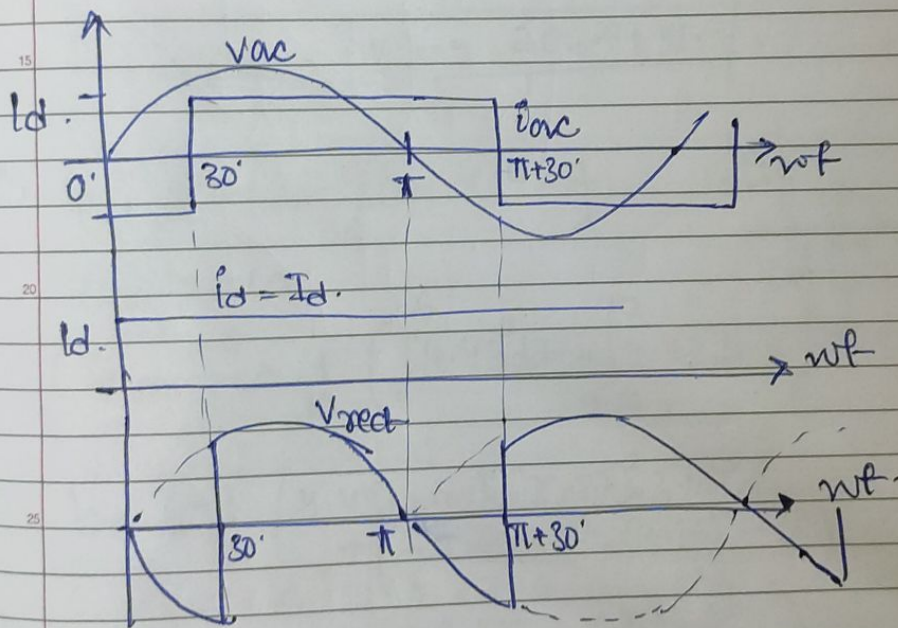
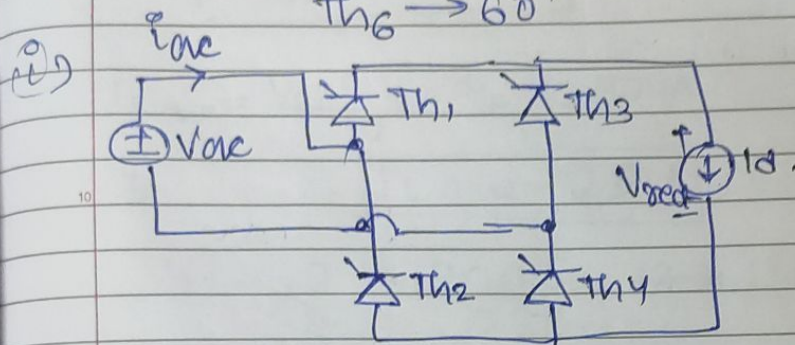


Mamni Uniyal,
19EE10039.

Q10

$$V_{ac} = 325 \sin(100\pi t)$$

$$\begin{aligned} \theta_{Th1}, \theta_{Th4} &\rightarrow 30^\circ \\ \theta_{Th2}, \theta_{Th3} &\rightarrow 210^\circ \\ \theta_{Th5} &\rightarrow 240^\circ \\ \theta_{Th6} &\rightarrow 60^\circ \end{aligned}$$



$$V_{rect, avg} = \frac{2\sqrt{2}}{\pi} V_g \cos \alpha = 179.18 \text{ V.}$$

$$I_{ac, rms} = I_d = 10 \text{ A.}$$

$$P_{ac} = \frac{2\sqrt{2}}{\pi} V_g I_d \cos \alpha = 1.79 \text{ kW.}$$

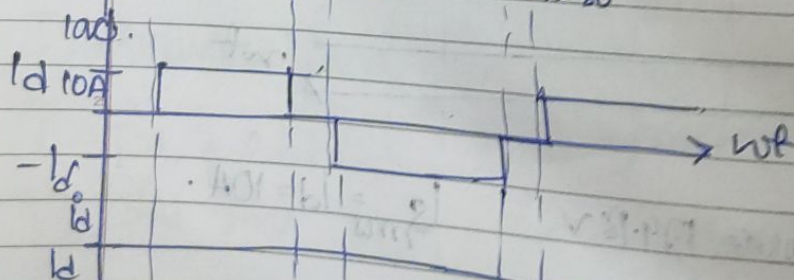
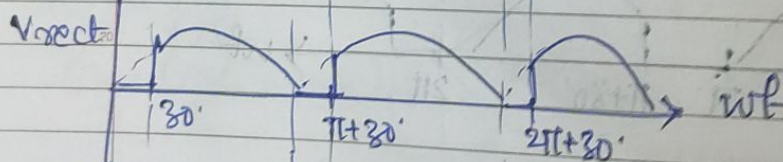
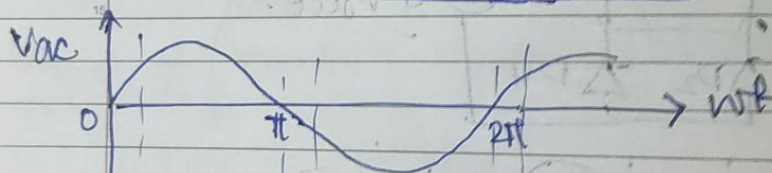
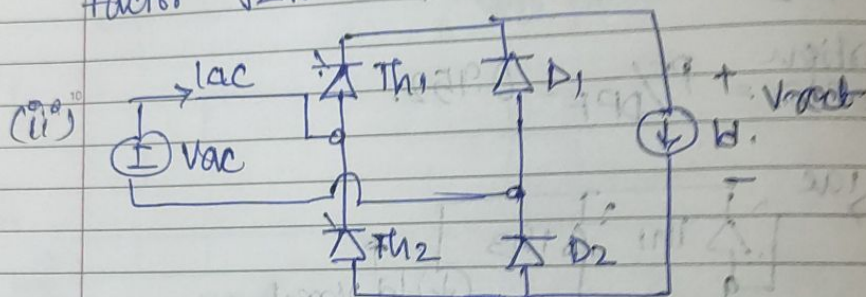
193.04 V.

$$\text{DPF} = \cos \alpha = 0.867$$

$$\text{PF} = \frac{I_{S1}}{I_S} \quad \text{DPF} = \frac{2\sqrt{2}}{\pi} \cos \alpha = 0.779$$

$$\% \text{THD} = \frac{100}{I_S} \sqrt{I_S^2 - I_{S1}^2} = 48.43\%$$

$$\text{Distortion Factor} = \frac{4}{\sqrt{2}\pi} = 0.9$$



$$V_{\text{rect avg}} = \frac{\sqrt{2}}{\pi} \int_{30^\circ}^{\pi} V_{ac} \sin \omega t \, d(\omega t) = \frac{(V_{ac})_m}{\pi} (1 + \cos \alpha) = 193.04 \text{ V}$$

$$I_{ac \text{ rms}} = \sqrt{1 - \frac{30^\circ}{\pi}} I_d = 9.128 \text{ A}$$

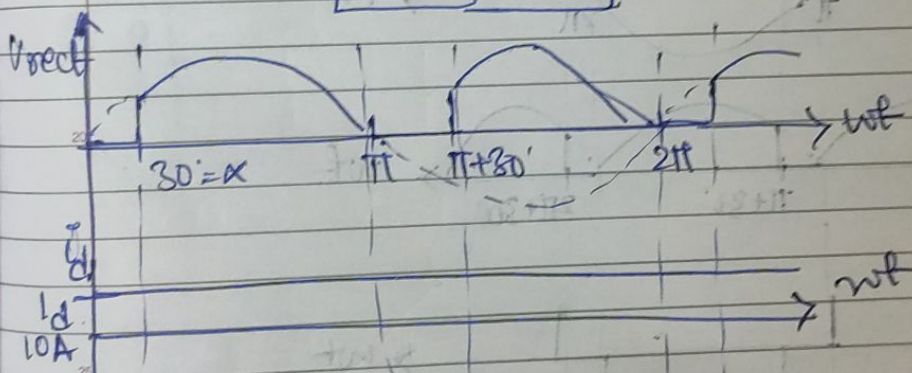
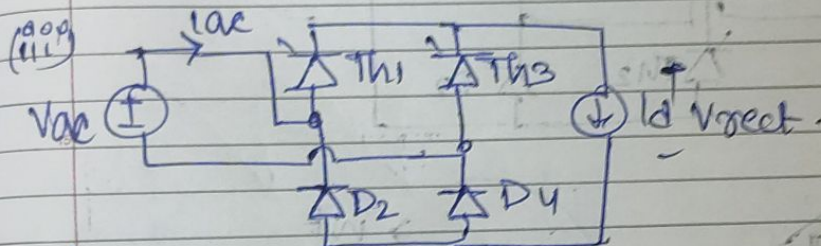
$$P_{ac} = \frac{(V_{ac})_m I_d (1 + \cos \alpha)}{\pi} = 1.762 \text{ W}$$

$$\text{Displacement factor} = \frac{(V_{ac})_m (1 + \cos \alpha) I_d}{\pi} = 0.966$$

$$\frac{(V_{ac})_m \frac{4}{\sqrt{2}} I_d \cos(\frac{\alpha}{2})}{\pi \sqrt{2}}$$

$$PF = \frac{(V_{ac})_{in}}{(V_{in})_{rms} \times (I_{in})_{rms}} = \frac{\sqrt{2} I_d (1 + \cos \alpha)}{\pi (I_{ac})_{rms}} = 0.92$$

$$\text{Distortion factor} = PF / DPF = 0.952$$



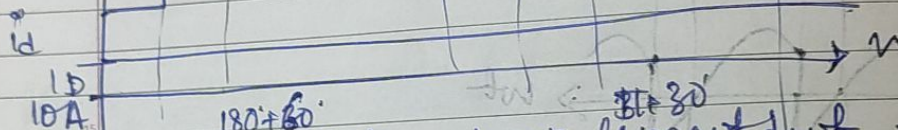
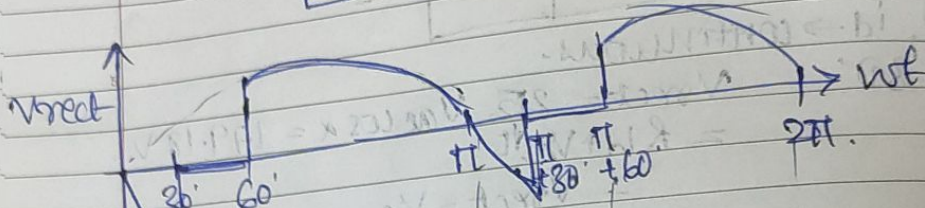
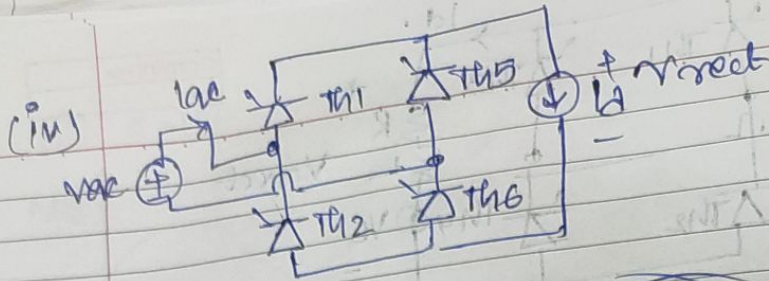
$$V_{rect, avg} = \frac{2V_m \cos \alpha}{\pi} = 179.18 \text{ V} \quad I_{s, rms} = I_d = 10 \text{ A}$$

$$P_{ac} = \frac{V_s \sqrt{2} I_d \cos \alpha}{\pi} = 1.792 \text{ kW}$$

$$DF = \cos \alpha = 0.867$$

$$CDF = \frac{2\sqrt{2}}{\pi} = 0.9$$

$$PF = \frac{2\sqrt{2}}{\pi} \cos \alpha = 0.779$$



$$V_{rect\ avg} = \frac{1}{\pi} \int_{30^\circ}^{180+60^\circ} V_{rect} d(\omega t) = \frac{1}{\pi} \int_{30^\circ}^{240^\circ} V_m \sin \omega t d\omega t = \frac{325}{\pi} = 103.45 \text{ V}$$

$$I_{ac} = I_m \sqrt{\frac{150}{180}} = 9.13 \text{ A}$$

$$P_{in} = \frac{(V_{ac})_{rms} (I_{ac})_{rms}}{\pi} = 944.49 \text{ W}$$

$$\text{Displacement factor} = \frac{P_{in}}{(V_{in})_{rms} (I_{ac})_{rms}} = 0.683$$

$$PF = \frac{P_{in}}{V_{in\ rms} I_{ac\ rms}} = 0.674$$

$$\text{Distortion factor} = \frac{PF}{DPF} = 0.986$$

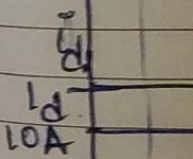
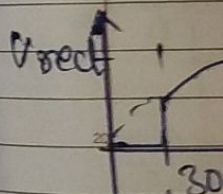
$$P_{ac} = \frac{V_{ac}}{V_{in}}$$

Displacement factor

$$PF = \frac{(I_{ac})_{rms}}{(V_{in})_{rms}}$$

Distortion factor

$$V_{ac} = \frac{V_{m}}{\sqrt{2}}$$

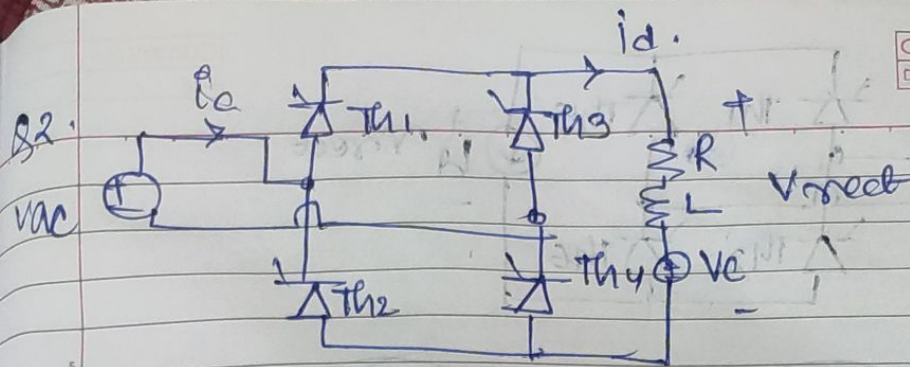


$$V_{rect\ avg} = \frac{V_m}{\pi}$$

$$P_{ac} = \frac{V_{ac}}{V_{in}}$$

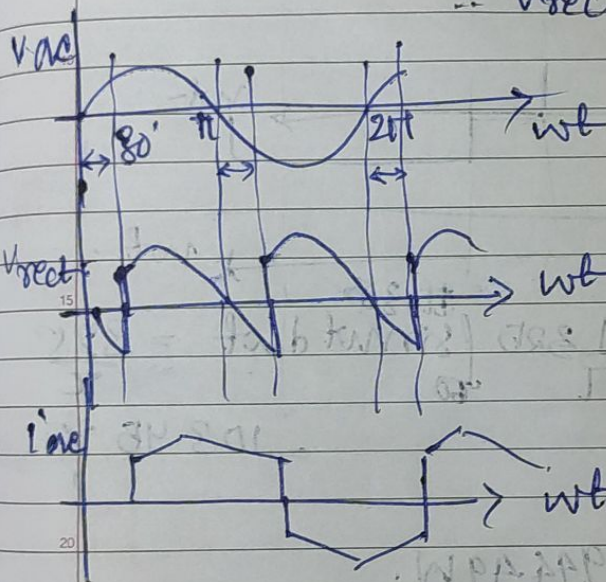
$$IDF = \frac{V_{rect\ avg}}{V_{ac}}$$

$$CDF = \frac{P_{ac}}{P_{in}}$$

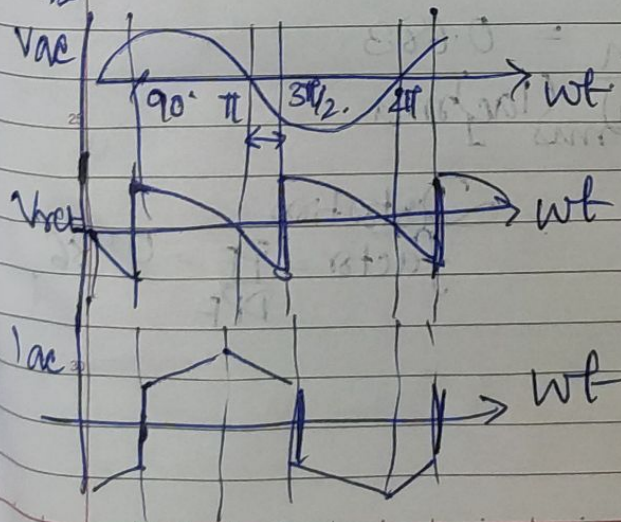


i) $R=0$, $i_d \rightarrow$ continuous.

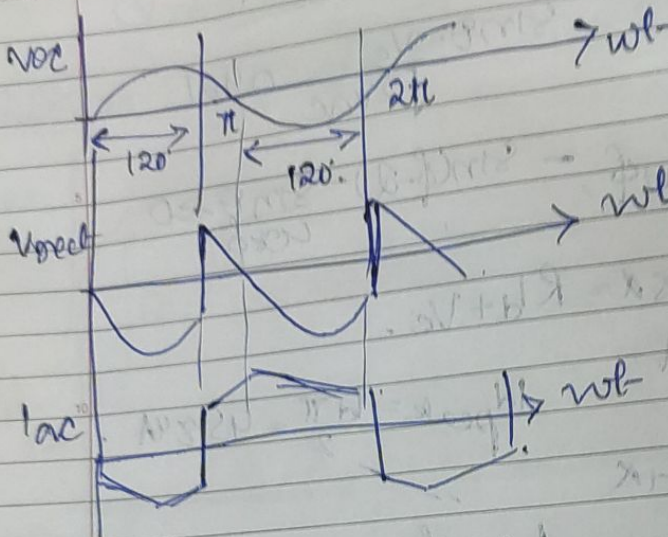
(a) $\alpha = 30^\circ$ $V_{rect} = \frac{2\sqrt{2}}{\pi} V_{ac} \cos \alpha = 179.18 \text{ V}$
 $= R i_d + V_c$
 $\therefore V_{rect} = V_c$



(b) $\alpha = 90^\circ$ $V_{rect} = 0, \neq V_c$



(c) $\alpha = 120^\circ$ $V_{rect} = -103.45 \text{ V} = V_c$



(ii) i_d will be continuous when converter in CCM.

$$\frac{2 \sin(\phi - \alpha)}{1 - e^{-\pi/\tan \phi}} - \sin(\phi - \alpha) - \frac{\sin \theta}{\cos \phi} \geq 0$$

$\frac{V_{ac}}{\sqrt{2} V_{ac}}$
 $\frac{V_{ac}}{R}$
 \rightarrow firing angle.

assume.

$$L = 0$$

$$\therefore \phi = 0$$

(a) $V_c = 110 \text{ V}$ $\sin \alpha \leq \frac{110}{325} \leq 0.338$

(b) $V_c = 0$ $\sin \alpha \leq 0$ $\alpha \geq 0^\circ$
 $\alpha \leq 19.75^\circ$

(c) $V_c = 110 \text{ V}$ $\sin \alpha \leq 0.338$

(ii) $R = 1 \Omega$

$\alpha = 30^\circ$

$V_c = 150 V$

$L = 12 mH$

$\tan^{-1} \frac{\omega L}{R} = \phi = 75.14^\circ$

$\sin \theta = \frac{V_c}{\sqrt{2} V_{ac}} = 0.461$

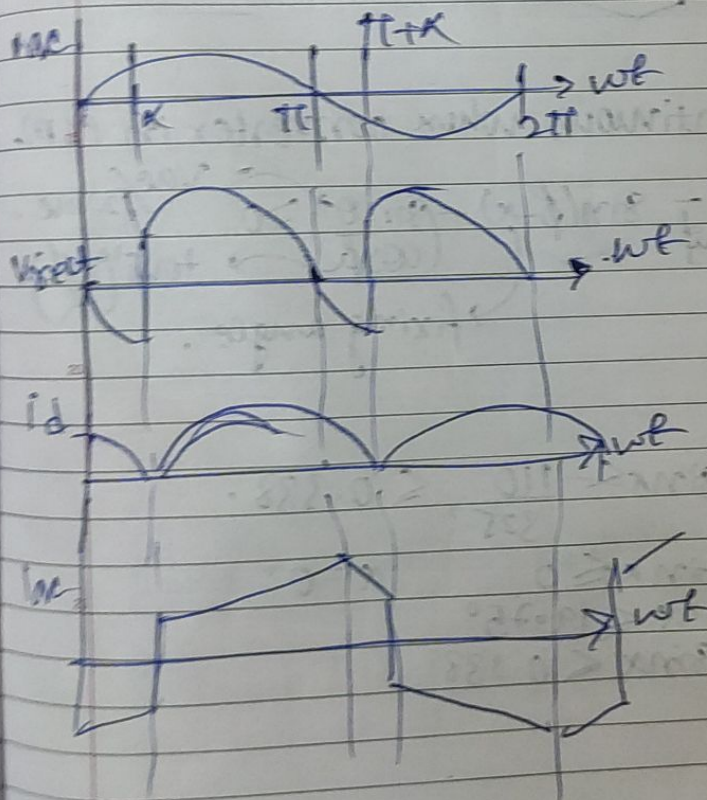
for CCM ✓

$\frac{2 \sin(\theta - \alpha)}{1 - e^{-1/\tan \phi}} - \sin(\theta - \alpha) - \frac{\sin \theta}{\cos \phi} \geq 0$

$V_{rect} = \frac{2 V_m \cos \alpha}{\pi} = R I_d + V_c$

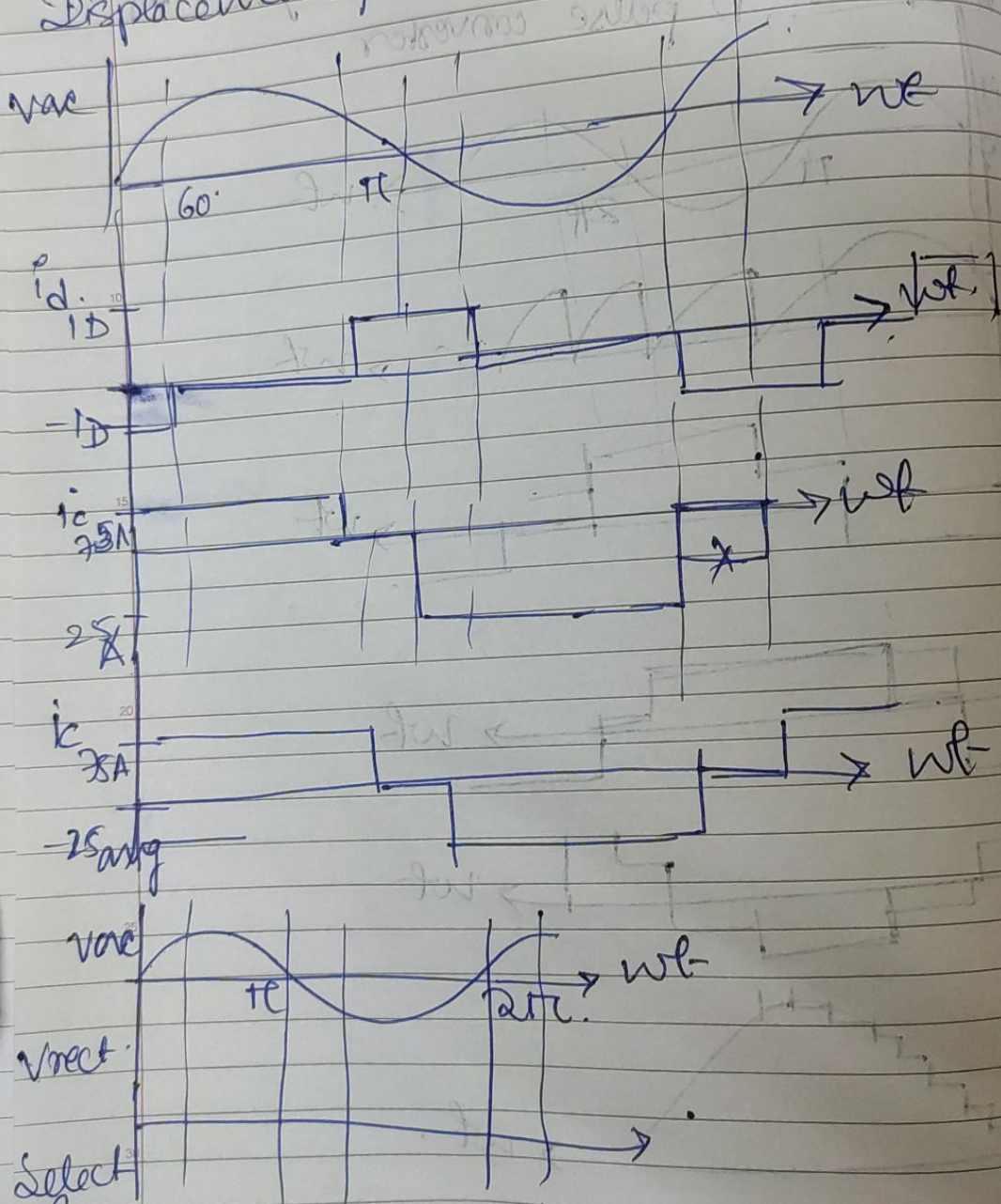
$I_d = 29.18 A$

$I_{d, peak} = \frac{I_d \pi}{2} = 45.84 A$



Q4. (ii) $\alpha = 90^\circ$
 $(V_{rect} \cos \alpha = \frac{3\sqrt{2}}{\pi} V_m \cos \alpha = 0)$

Displacement factor = 0 = PF



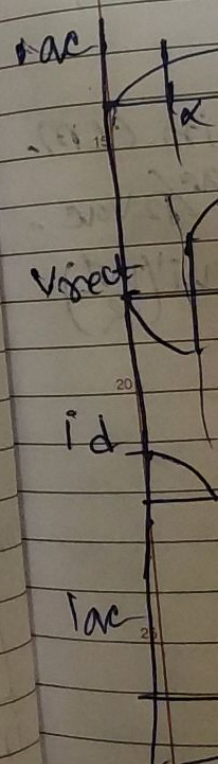
Select
Bye.

$I_{rect} = 0$

(iii) $R = 12$
 $\alpha = 30^\circ$
 $V_c = 15$
 $L = 12$

for CCM,
 $28m$
 $1 -$

V_{rect}
 10
 12



i_d
 20
 10
 0

Q6. $V_{LL} = 415 \text{ V}$ wt.
 $V_{ab} = 55 \text{ V}$ wt. β

$V_{rect} = V_{rect \text{ hands}}$, $V_{rect} V_{rect t} = 4.75^\circ$

$\phi = 75^\circ$, 12 pulse converter.

