Power Electronics Lab Experiment-3

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19EE3FP18

Part B:-

1.

Average DC output voltage, V_{DC} = 380V
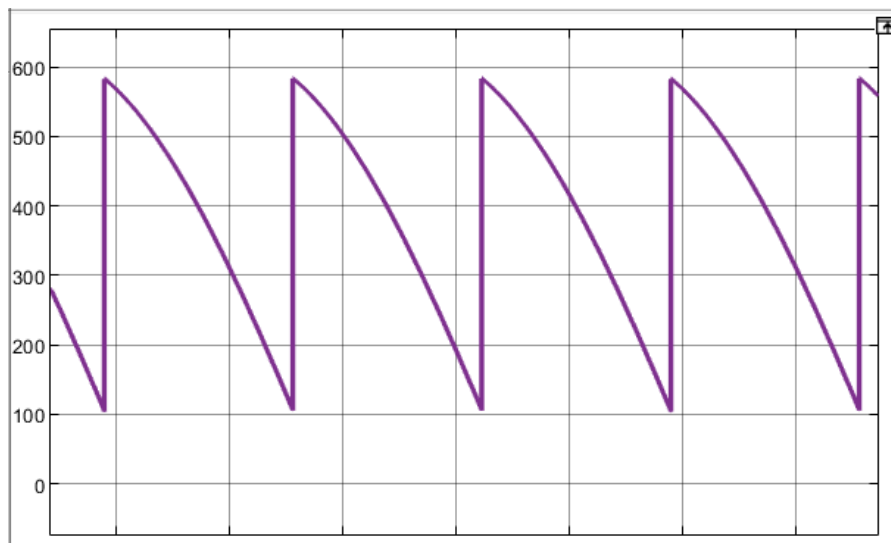
Line-to-line RMS voltage, V_{LL} = 440V

We know, $V_{DC} = \frac{3\sqrt{2}}{\pi} V_{LL} cos\alpha$

So, $cos\alpha = \frac{380 \times \pi}{440 \times 3\sqrt{2}} = 0.6395$
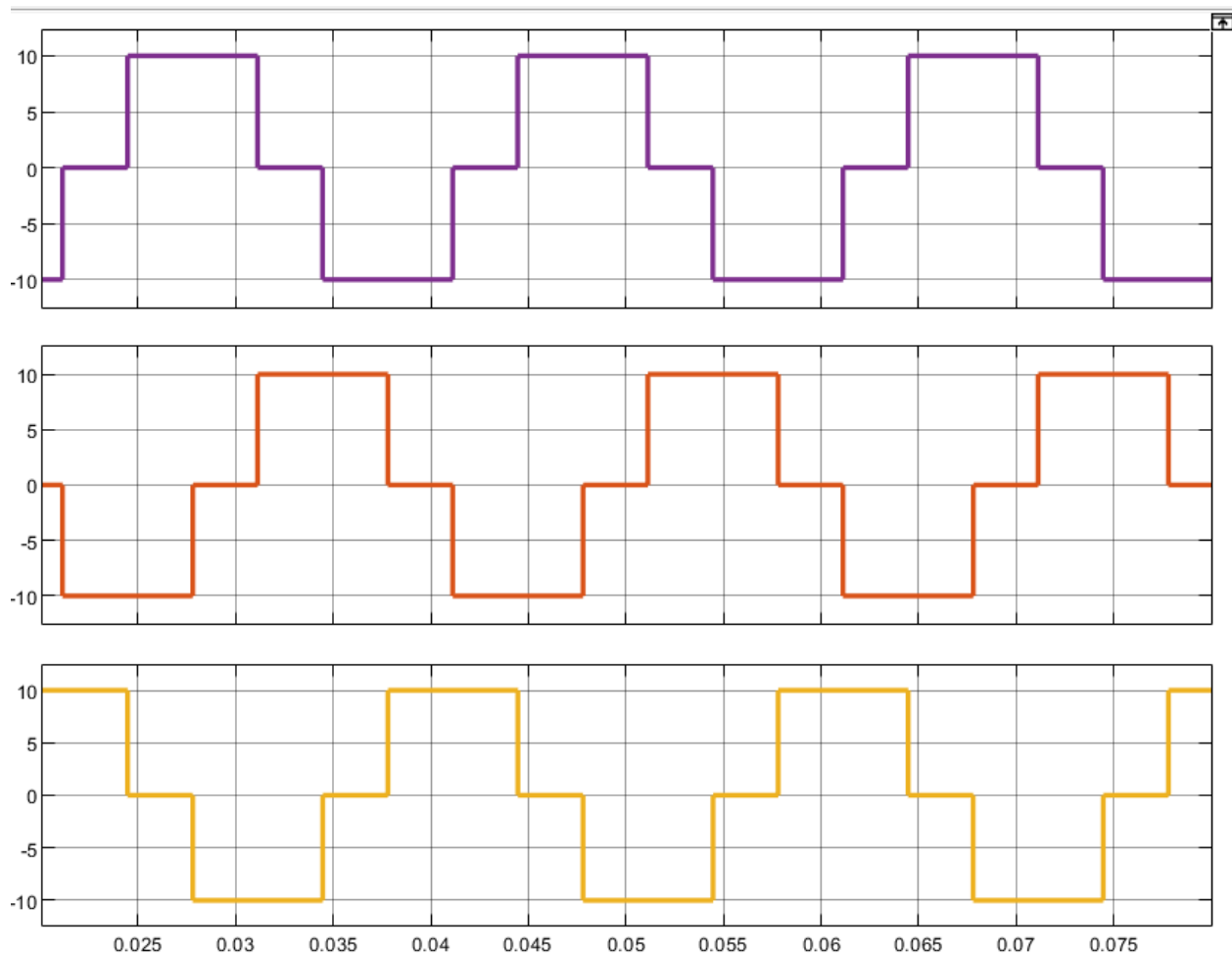
So, firing angle α = 50.245°

2.

Load voltage:-

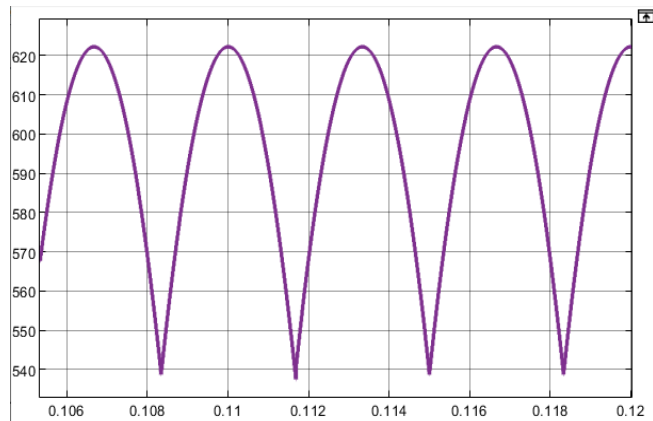$V_{DC,avg}$ = 379.4V

AC side current waveforms for 3 phases:-

3.
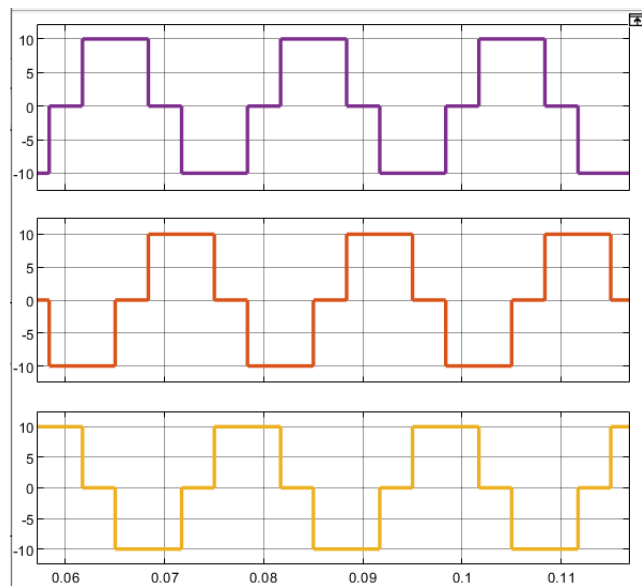Maximum reverse voltage across the thyristor = -622.2V

4.

Now we will vary α from 0° to 60° and note the output voltage and AC side currents.
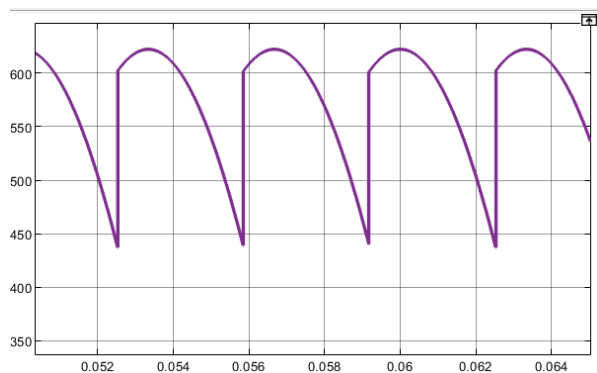
For $\alpha=0°$, V_{DC}

Average = 594.1V Calculated = 594.2V
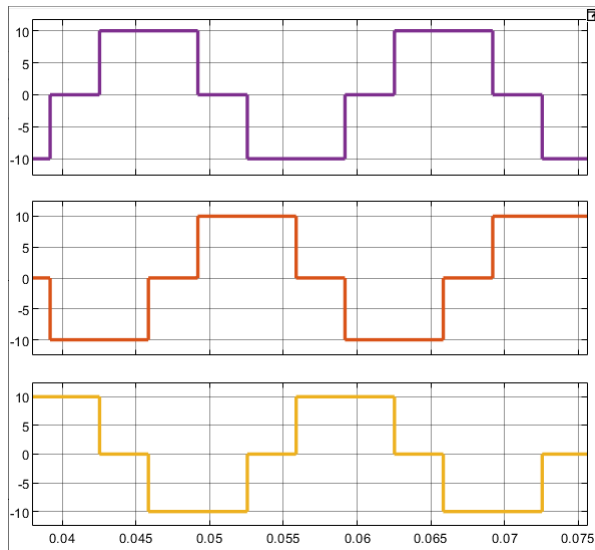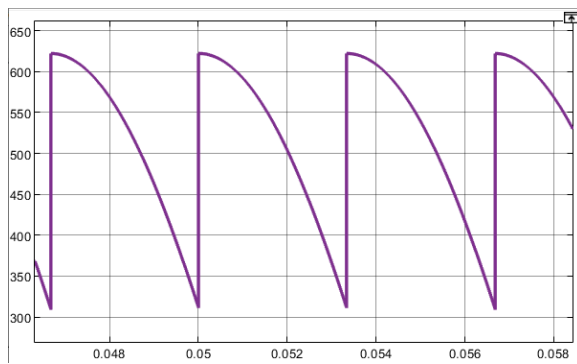
AC side currents

For $\alpha=15°$, V_{DC}

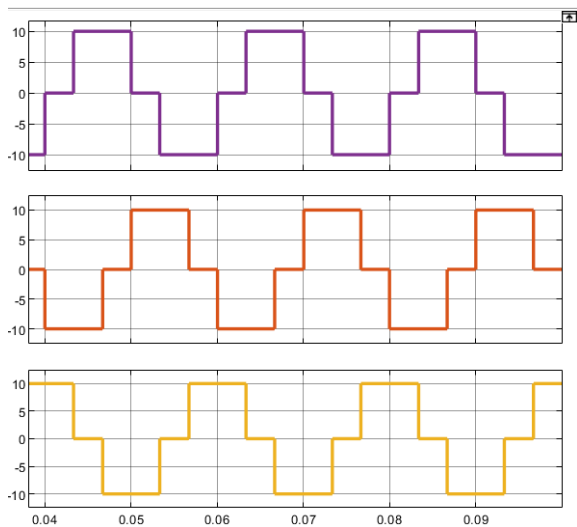Average = 573.1V Calculated = 573.96V

AC side currents
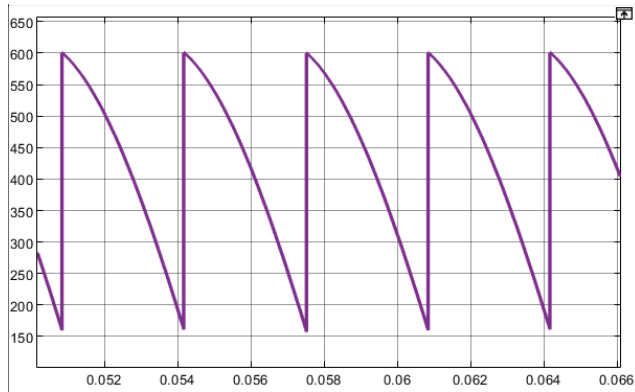

For α=30°, V_{DC}

Average = 513.5V Calculated = 514.6V
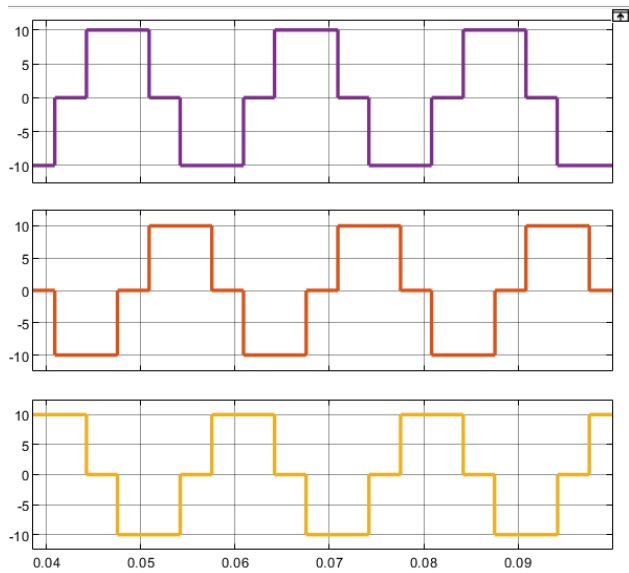
AC side currents

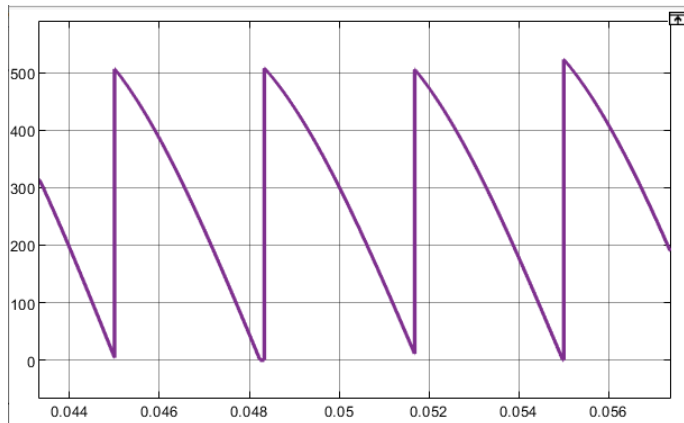## For $\alpha=45°$, V_{DC}

Average = 420.8V Calculated = 420.17V
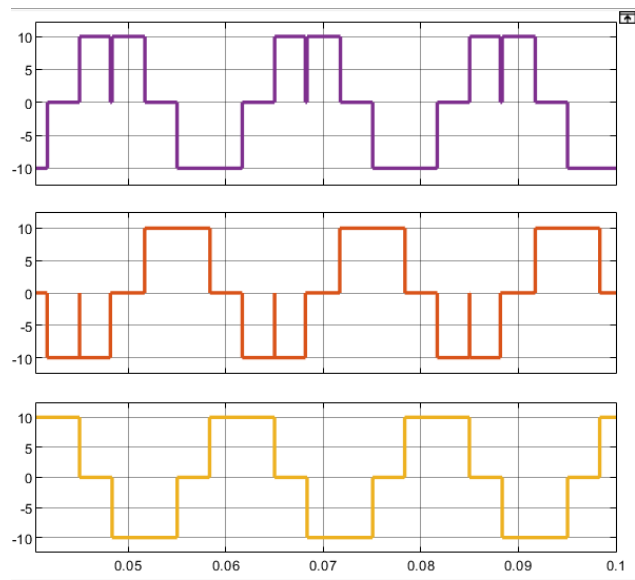
AC side currents

For $\alpha=60°$, V_{DC}

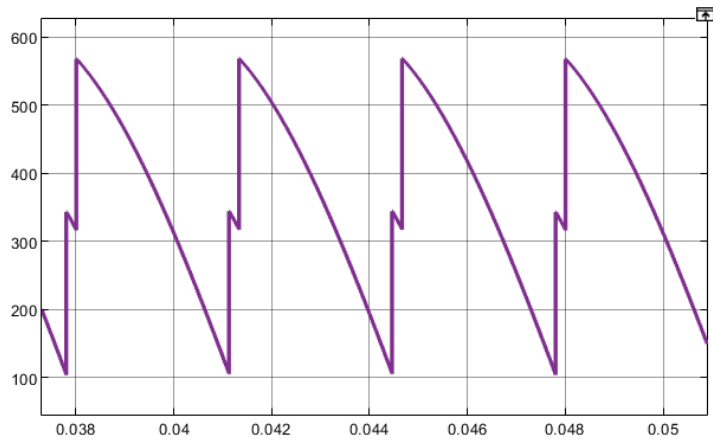Average = 290.6V Calculated = 297.1V
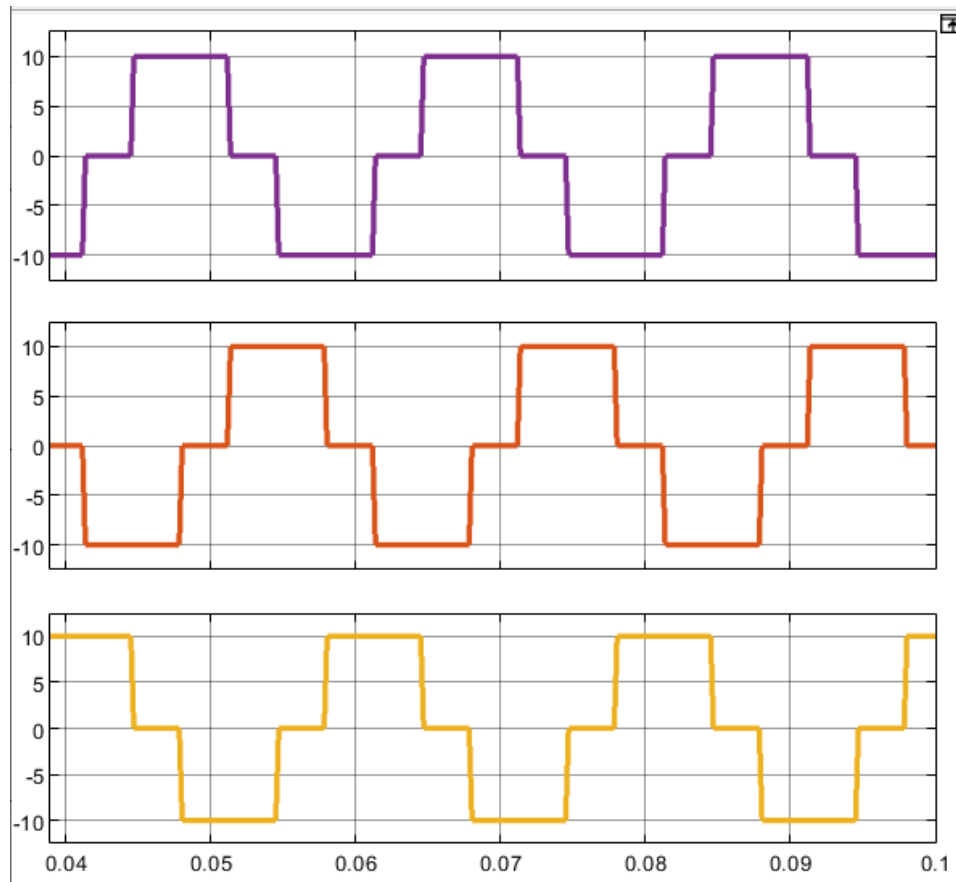
AC side currents

5.
Source inductance = 5mH
Load voltage:-

$V_{DC,avg}$ = 365.4V

AC side current waveforms for 3 phases:-

PART-C:-

1.

We know $V_{DC} = \frac{3\sqrt{2}}{2\pi} V_{LL}(1 + cos\alpha)$
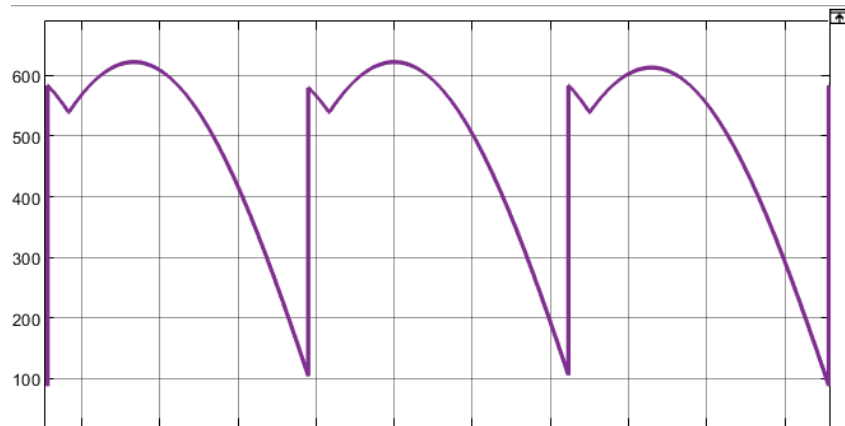
α is given, 45°

Hence $V_{DC} = \frac{3\sqrt{2}}{2\pi} \times 440 \times (1 + \frac{1}{\sqrt{2}}) = 507.189V$
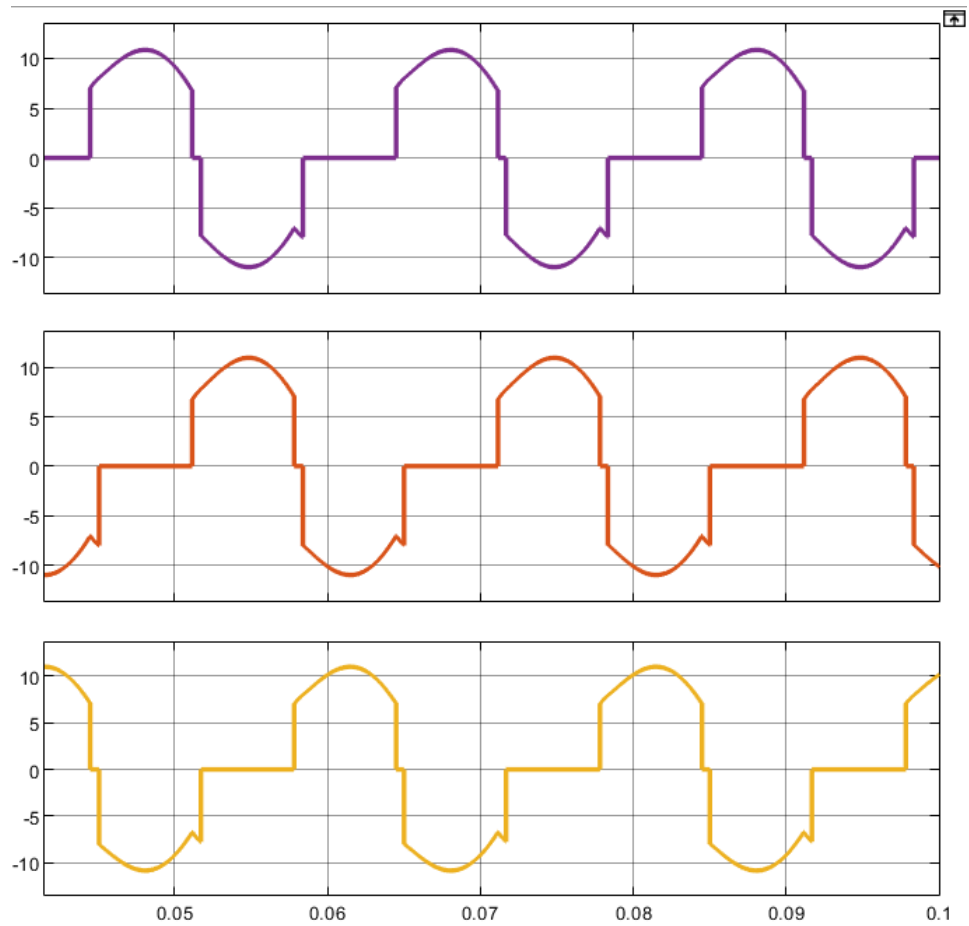
For 10A Load current, R$_{Load}$ = 50.7189Ω

2.
Load voltage:-

$V_{DC,avg}$ = 481.4V

AC side current waveforms for 3 phases:-

Part-D:-

$\alpha = 30°$

Hence the output voltages of,

3-phase full controlled rectifier will be, $V_{DC} = 514.6V$

3-phase semi controlled rectifier will be, $V_{DC} = 554.4V$

Parameter	Full-controlled converter	Semi-controlled converter
AC side current(RMS)	8.1573	8.1604
Fundamental component of AC side currents(RMS)	7.788	7.524
THD(in%) of the AC side currents	31.16%	41.99%
Input power factor	0.8268	0.8906
Fundamental active power(W)	8903.13	9592.45
Fundamental Reactive power(VAr)	5140.08	2570.52