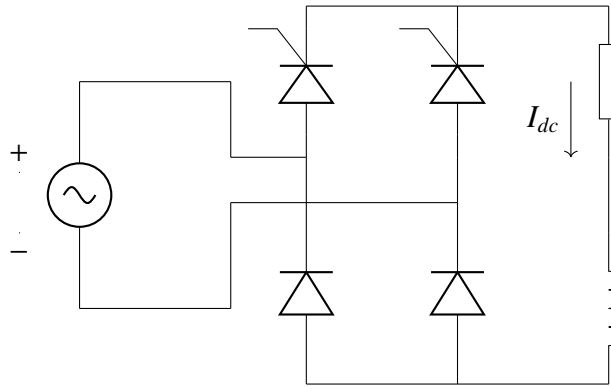# GATE: EE - 59.2022

EE23BTECH11013 - Avyaaz[*]

Question: For the ideal AC-DC rectifier circuit shown in the figure below, the load current magnitude is I_{dc} = 15 A and is ripple free. The thyristors are fired with a delay angle of 45°. The amplitude of the fundamental component of the source current, in amperes, is _____(*Round off to 2 decimal places*).   (GATE 59 EE 2022)
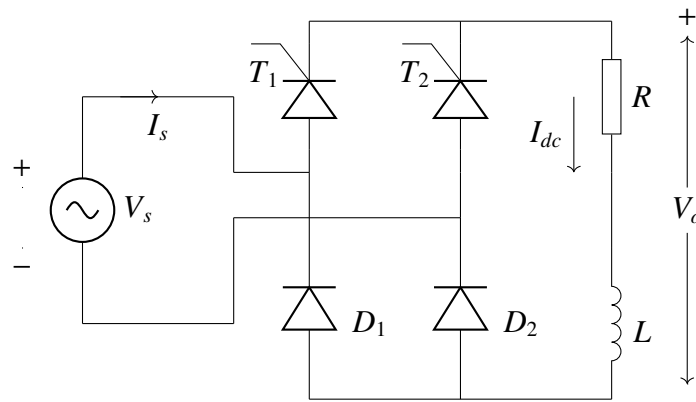

Solution:

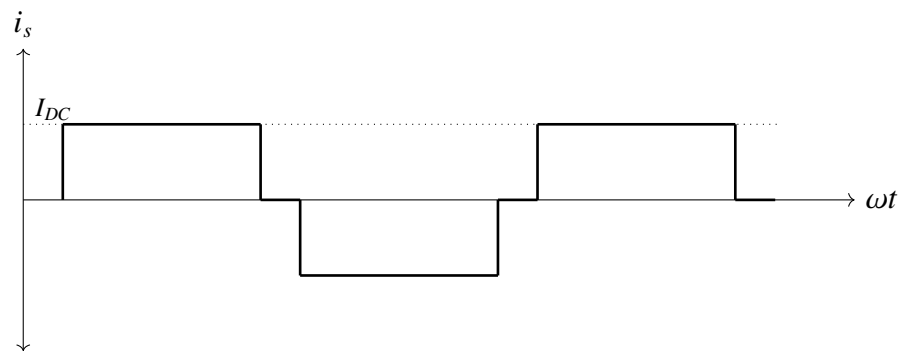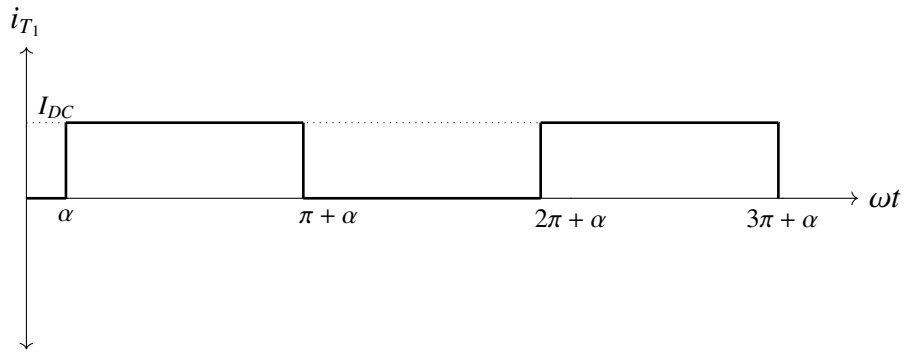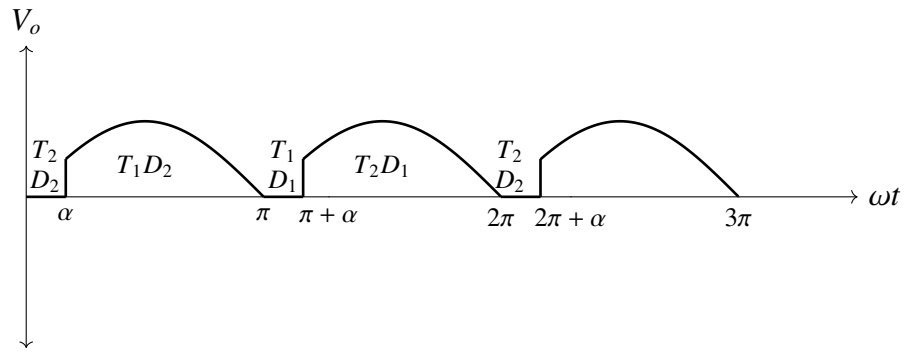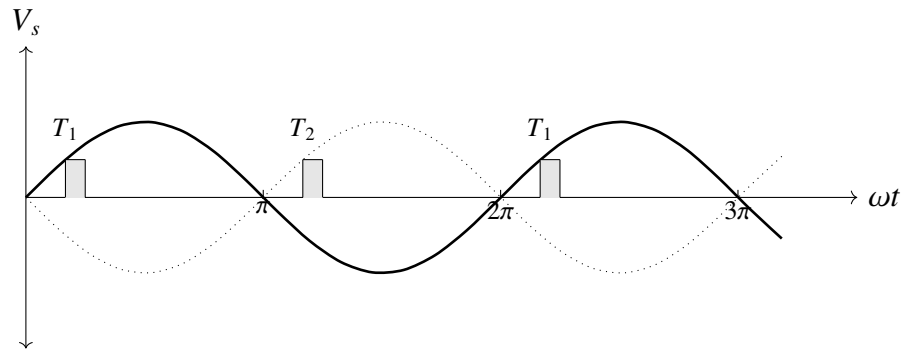| Parameter	Description	Value
I_{dc}	Load current	15A
α	Firing angle	45°

TABLE 1

A symmetrical single phase semi converter is shown below,

The Fourier series representation of supply current is given by:

$$I_s(t) = \sum_{n=1,3,5...}^{\infty} \frac{4I_{dc}}{n\pi} \cos\frac{n\alpha}{2} \sin\left(n\omega t - \frac{n\alpha}{2}\right) \tag{1}$$

V_s

T_1 T_2 T_1

π 2π 3π ωt

V_o

T_2 T_1 T_2
D_2 $T_1 D_2$ D_1 $T_2 D_1$ D_2

α π $\pi + \alpha$ 2π $2\pi + \alpha$ 3π ωt

i_{T_1}

I_{DC}

α $\pi + \alpha$ $2\pi + \alpha$ $3\pi + \alpha$ ωt

i_s

I_{DC}

ωt

From Table 1:

$$(I_{s_1})_{peak} = \frac{4I_{dc}}{\pi} \cos\left(\frac{\alpha}{2}\right) \tag{2}$$

$$= \frac{4 \times 15}{\pi} \times \cos\frac{45°}{2} \tag{3}$$

$$= 17.64A \tag{4}$$