Assignment - 3

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Section: 01

Course: CSE251

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Ans. to the Ques No. - 1

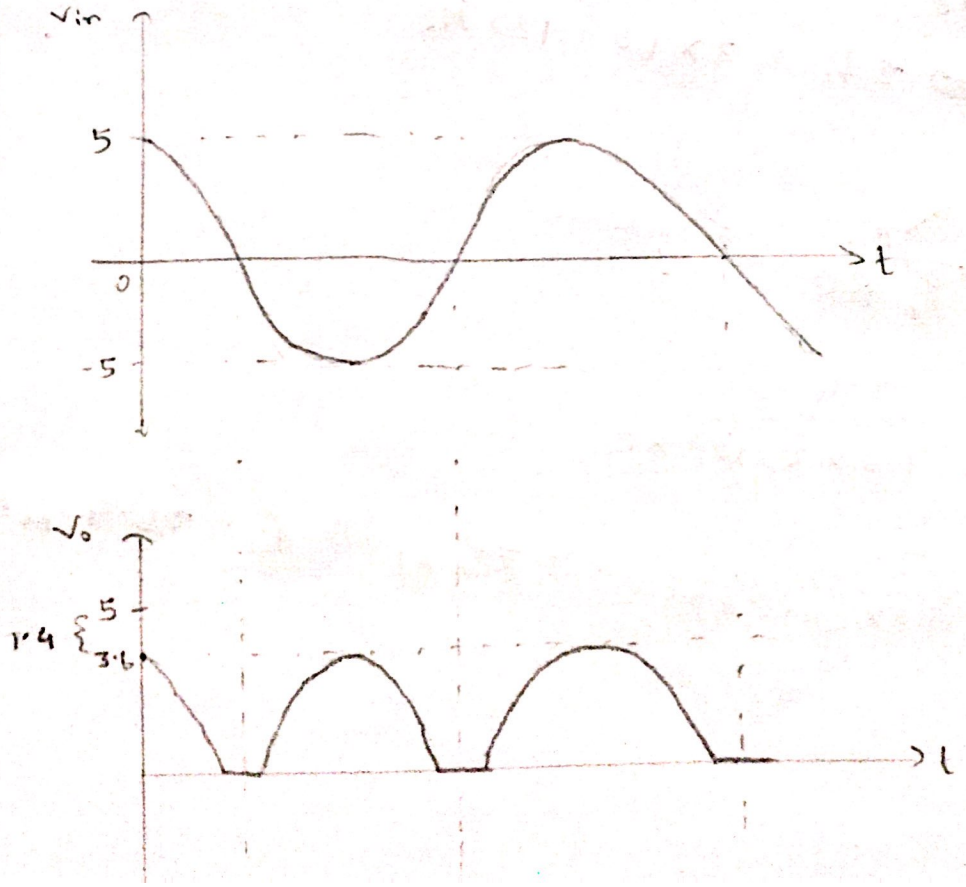
a

A rectifier converts AC to DC. In a full-wave bridge, during each half-cycle a pair of diodes conducts and flips the negative half-upright, so ~~that~~ the load sees the absolute value of the input minus two diode drops in series.

b

$5\cos(2\pi 60t)V = 5\cos(377t)\ V \rightarrow V_{in}$

$V_o = 5 - (2 \times 0.7) = 3.6$



c

$$V_{DC} = \frac{2V_m}{\pi} - 2V_{D_0} = \frac{2\times 5}{3.1416} - 2\times(0.7) = 1.78\ V$$

j

$$V_r = +0.2 - (-0.2) = 0.4\ V$$

$$V_p = 5 - 2\times(0.7) = 3.6\ V$$

$$R = 2\ k\Omega = 2\times10^3\ \Omega$$

$$f_s = 60\ Hz$$

$$f_r = 2f_s = 2\times60 = 120\ Hz$$

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

$$\Rightarrow 0.4 = \frac{3.6}{120\times2\times10^3\times C}$$

$$\therefore C = \frac{3.6}{120\times2\times10^3\times0.4} = 3.75\times10^{-5}\ f = 35.4\ \mu F$$

e

$$V_{DC_e} = V_p - \frac{V_r}{2}$$

$$= 3.6 - \frac{0.4}{2}$$

$$= 3.4$$

From c, $V_{DC} = 1.78V$

Adding the capaciton made the V_{DC} almost twice.

Ans. to the Ques. No. 2

a

~~$V_p = V_m = V$~~

$V_m = 10\ V$

$V_{D_0} = 0.4 V$

$$V_{DC} = \frac{V_m}{\pi} - \frac{1}{2} V_{D_0} = \frac{10}{3.1416} - \frac{1}{2}(0.4) = 2.98\ V$$

b

$$V_n = 0.3 - (-0.3) = 0.6 V$$

$f_n = 55\ Hz$

$R = 2.5 k\Omega = 2.5 \times 10^3\ \Omega$

$$V_p = V_m - V_{D_0} = 10 - 0.4 = 9.6$$

$$V_n = \frac{V_p}{f_n R C}$$

$$\Rightarrow 0.6 = \frac{9.6}{55 \times 2.5 \times 10^3 \times C}$$

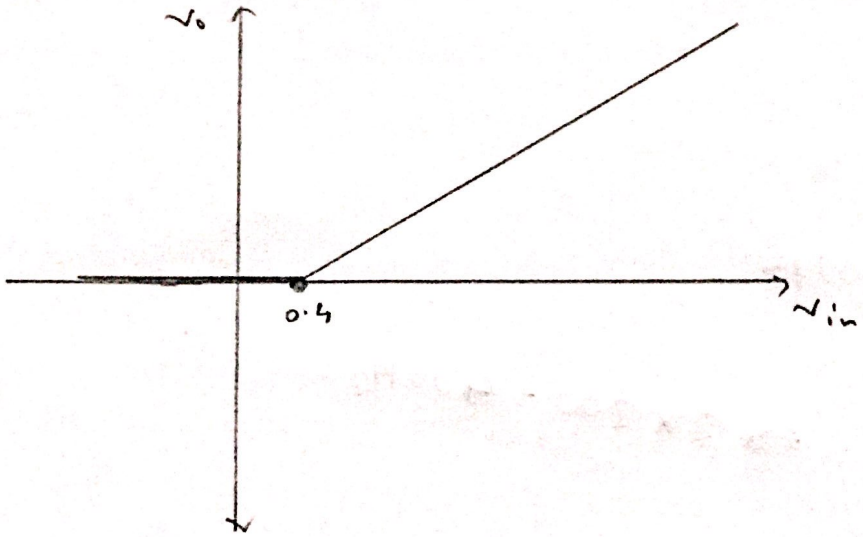
~~$\therefore C = 1.164 \times 10^{-4} f$~~

~~$= 164\ \mu f$~~

$\therefore C = 1.164 \times 10^{-4} f$

$= 116.4\ \mu F$

c



Ans. to the Ques No.-3

a

$v_s(t) = 7\sin(400\pi t)$

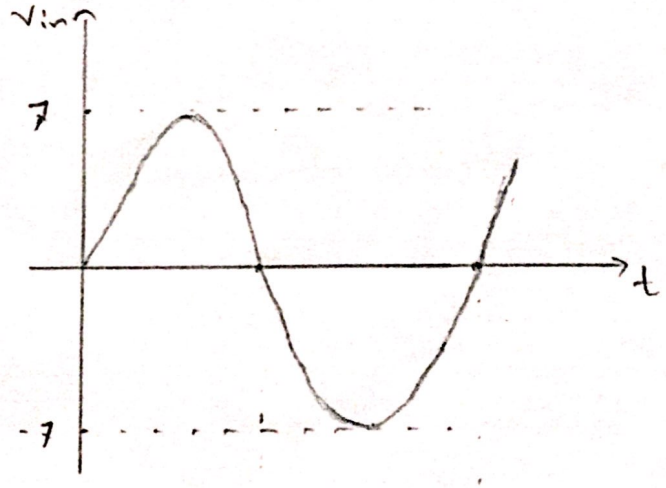
$\therefore \omega = 400\pi$

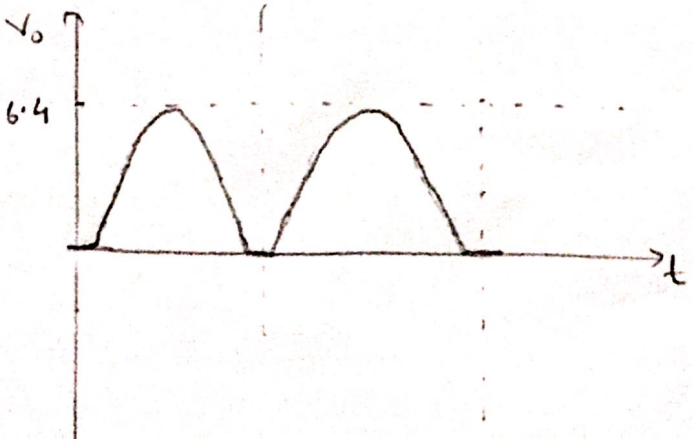
$\Rightarrow 2\pi f_s = 400\pi$

$\therefore f_s = 200\text{Hz}$

$\therefore f_\pi = 2f_s = 2 \times 200 = 400\text{Hz}$

b





$V_p = 7 - (2 \times 0.3)$

$= 6.4$

c

$R = 5k\Omega = 5\times10^3\ \Omega$

$C = 100Mf = 100\times10^{-6}\ f$

$V_p = V_m - 2V_{D_0} = 7-(2\times0.3) = 6.4V$

$f_n = 400\ Hz$

$$V_n = \frac{V_p}{f_n RC} = \frac{6.4}{400\times5\times10^3\times100\times10^{-6}} = 0.032V = 32mV$$

d

i. ~~be~~ I can increase C

ii. increase R

iii. increase frequency

e

$f_n = 400Hz$

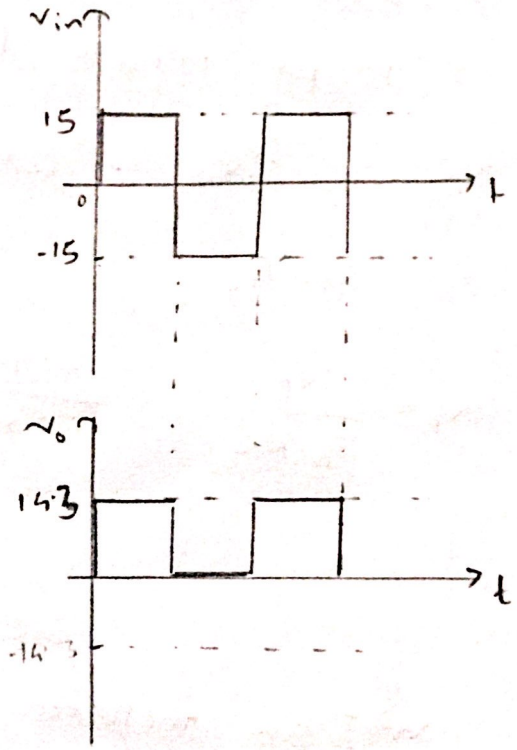
Ans. to the Ques. No. 4

a i

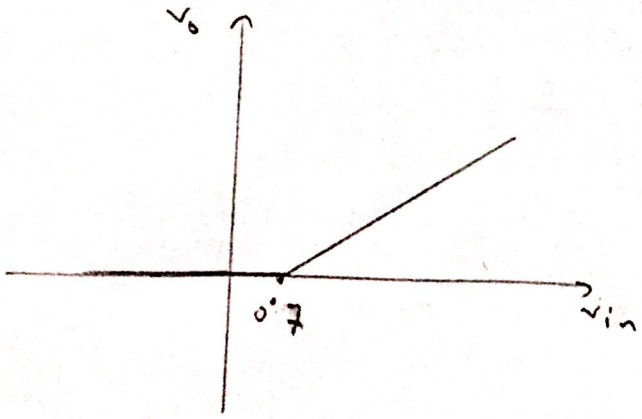
$V_m = 15V$

$V_{D_0} = 0.7V$

$V_p = 15 - 0.7 = 14.3V$



b ii



Ans. to the Qes. No. 5

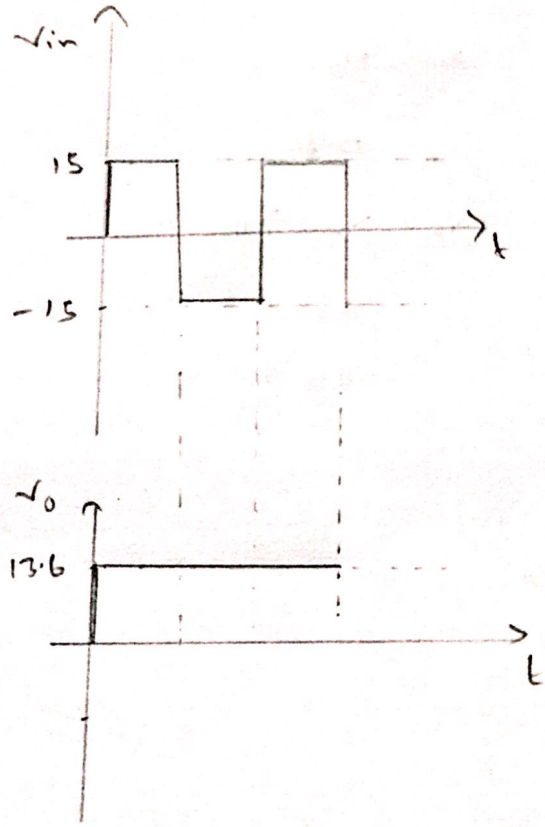
i

$V_m = 15V$

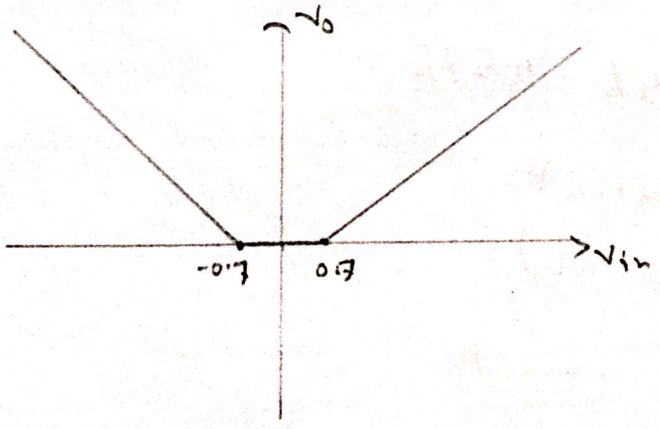
$V_{D_0} = 0.7V$

$V_p = 15 - 2 \times (0.7)$

$= 13.6V$

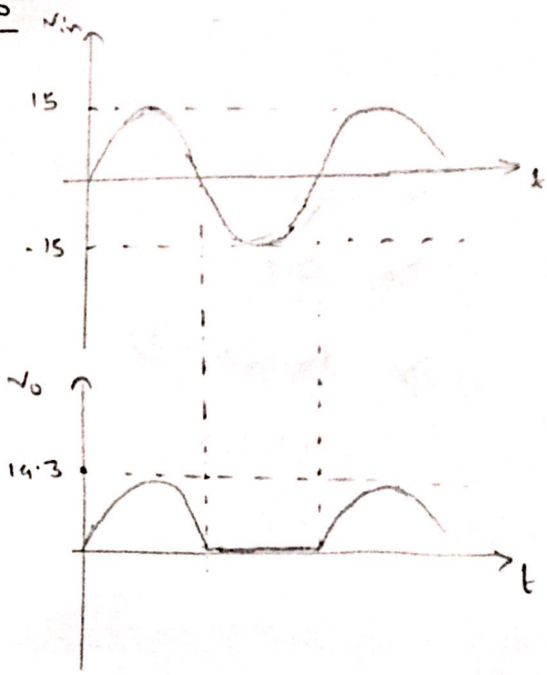


ii



Ans. to the Que. No-6

a



$V_m = 15$

$V_{D_0} = 0.7$

$V_p = V_m - V_{D_0}$

$= 15 - 0.7$

$= 14.3$

b

$$V_{DC} = \frac{V_m}{\pi} - \frac{1}{2} V_{D_0} = \frac{15}{3.1416} - \left(\frac{1}{2} \times 0.7\right) = 4.42\ V$$

c

$V_p = 14.3$

$V_n = 14.3 \times 4\% = 0.572$

$R = 5k\Omega = 5 \times 10^3 \Omega$

$V_i = 15 \sin(2000\pi t)$

$f_s = \frac{2000\pi}{2\pi} = 1000\ Hz$

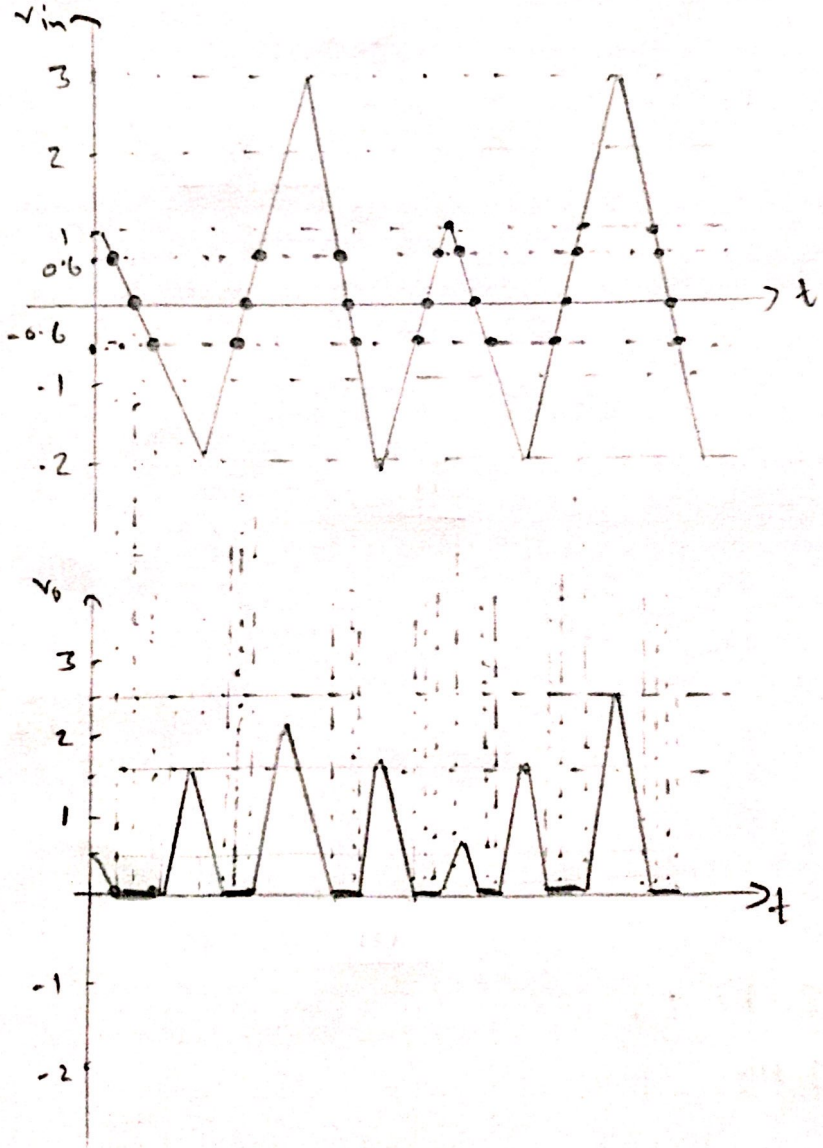
$f_n = 1000\ Hz$

$$V_n = \frac{V_p}{f_n RC}$$

$$\Rightarrow 0.572 = \frac{14.3}{1000 \times 5 \times 10^3 \times C}$$

$$\therefore C = 5 \times 10^{-6} F = 5\ \mu F$$

d



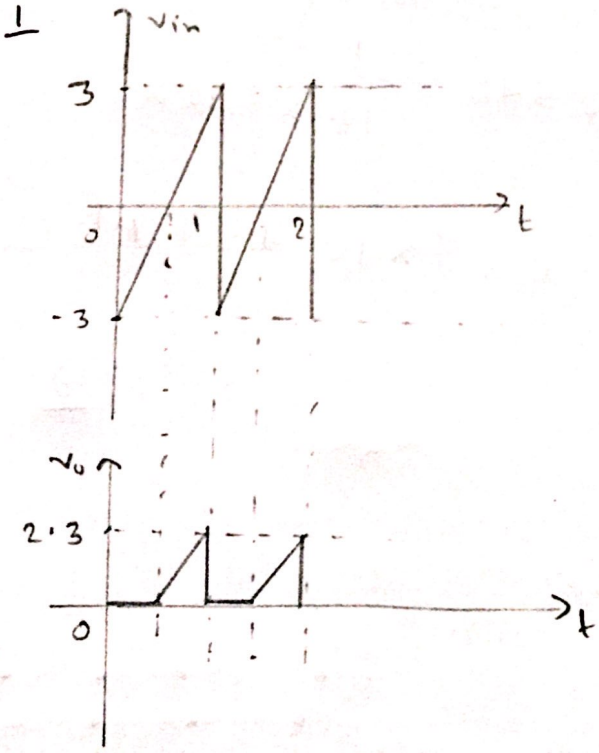
Ans. to the Ques. No. 7

$$V_m = \frac{4-(-2)}{2} = 3$$

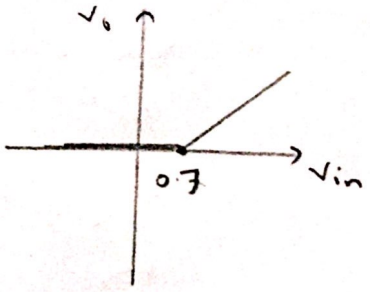
$$V_{D0} = 0.7$$

$$V_0 = 3 - 0.7 = 2.3$$

i



ii



iii

$$T = 2 - 1 = 1\,s$$

$$\therefore f_s = 1\,Hz$$

$$\therefore f_n = 1\,Hz$$

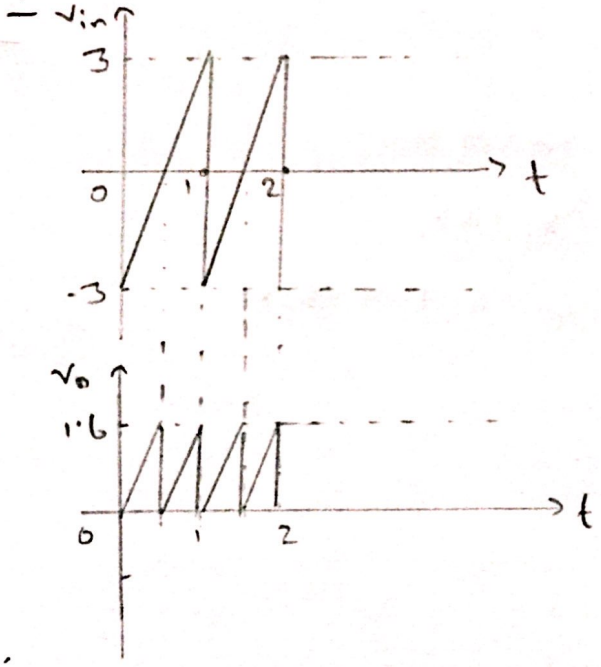
Ans. to the Ques No.-8

i

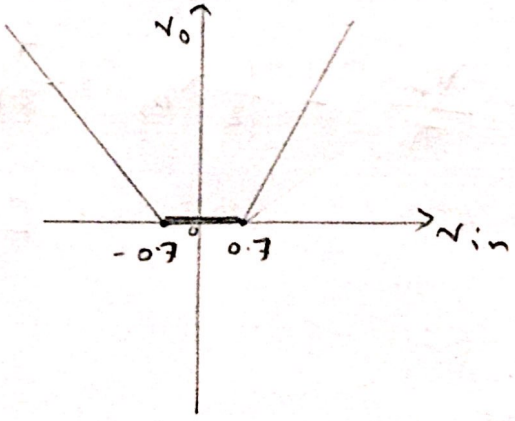
$$V_m = \frac{4-(-2)}{2} = 3$$

$V_{D_0} = 0.7$

$V_p = 3 - 2\times(0.7) = 1.6$



ii



iii

$T = 2 - 1 = 1\,s$

$\therefore f_s = 1\,Hz$

$\therefore f_n = 2 \times f_s = 2 \times 1 = 2\,Hz$

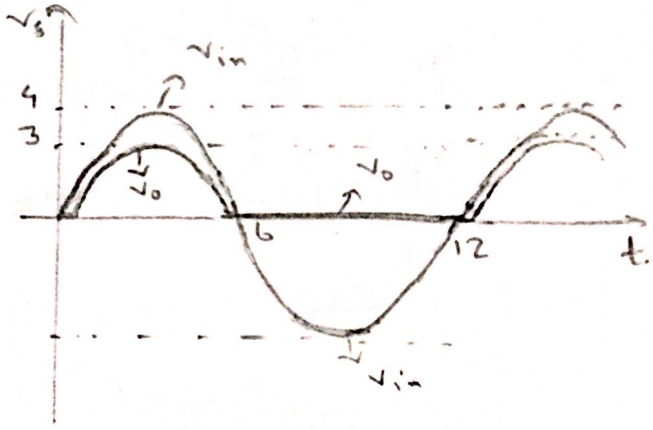
Ans. to the Ques. No. 3

a

$V_m = 4\,V$

$V_{D_0} = 1\,V$

$V_p = 4 - 1 = 3\,V$



b

$$V_{DC} = \frac{V_m}{\pi} - \frac{1}{2}V_{D_0} = \frac{4}{3.1416} - \left(\frac{1}{2} \times (1)\right) = 0.77\,V$$

c

at t_1, $\quad \because V_m = 4$

$$1 = 4\sin(\omega t_1)$$

$$\omega t_1 = \sin^{-1}\left(\frac{1}{4}\right)$$

$$= 14.48^\circ$$

we know that, $\frac{T}{2} \rightarrow 180^\circ$ or $\pi \rightarrow t_2 = \frac{T}{2} - t_1$

$$= 180^\circ - 14.48^\circ$$

$$= 165.52^\circ$$

∴ The diode conduct from 14.48° to 165.52°.

∴ Fraction of time for ~~which~~ which diode conducts : $\frac{165.52 - 14.48^\circ}{360^\circ} \times 100\%$

$= 41.95\%$

Ans to the Ques No. 10

a

Full-wave rectifier was used to rectify the sinusoidal voltage.

$T_o = 2\ ms$

$T_{in} = 4\ ms$

$f_{in} = 250\ Hz$

$f_{out} = 500\ Hz$

$\therefore T_o = \frac{1}{2} T_{in}$

$\therefore f_{out} = 2 \times f_{in}$

$\therefore$ Full-wave

b

$R = 4.5k\Omega = 4.5 \times 10^3\ \Omega$

$V_{b_0} = 0.5V$

$f_{in} = 250Hz$

$f_n = 250 \times 2 = 500\ Hz$

$V_p = 3.5$

$V_n = 3.5 - 3 = 0.5$

$$V_n = \frac{V_p}{f_n RC} \Rightarrow$$

$$\Rightarrow 0.5 = \frac{3.5}{500 \times 4.5 \times 10^3 \times C}$$

$\therefore C = 3.11 \times 10^{-6} F$

$= 3.11 \mu F$

c

$V_p = V_m - 2V_{b_0}$

$\Rightarrow V_m = V_p + 2V_{b_0} = 3.5 + 2 \times 0.5 = 4.5V$

$V_s(t) = 4.5 \sin(500\pi t)\ V$

d