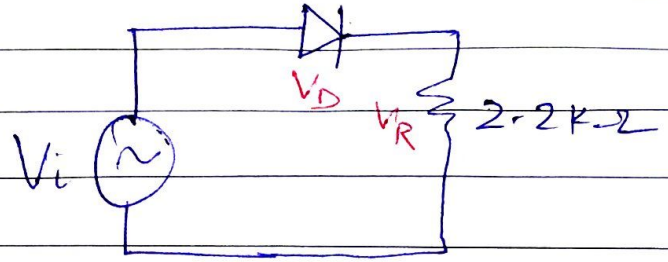
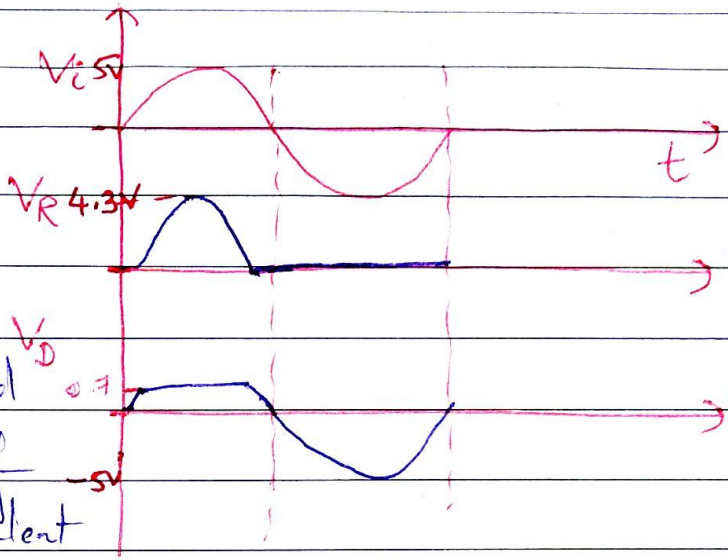
Q1. Solution Given $V_i = 5\sin 60t$, $V_D = 0.7V$, $R_L = 2.2k\Omega$

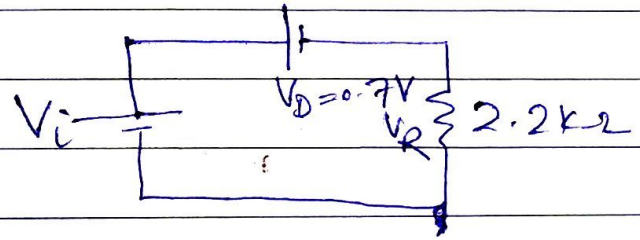




-2 marks

-2 marks

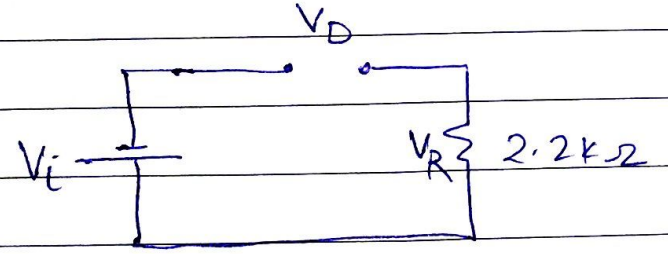
→ When diode is forward biased during positive half cycle of input waveform, the equivalent circuit is



Here $V_D = 0.7$

$V_R = V_i - V_D = (V_i - 0.7)V$

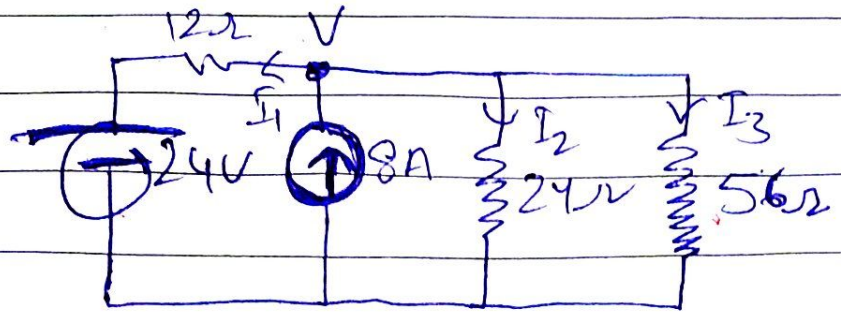
→ During negative half cycle of input waveform, diode is reverse biased. The equivalent circuit is



Here $I = 0$, $V_R = I \times 2.2 = 0$

$V_D = V_i$

Q2



4	12, 24, 56
3	3, 6, 14
2	1, 2, 14
	1, 1, 7

$$\frac{V-24}{12} + \frac{V}{24} + \frac{V}{56} = 8$$

LCM = 4 × 3 × 2 × 7

= 12 × 14 = 168

$$\frac{14(V-24)+7V+3V}{168} = 8$$

$$14V - 336 + 10V = 8 \times 168 = 1344$$

$$24V = 1344 + 336 = 1680$$

$$V = \frac{1680}{24} = 70 \rightarrow (3)$$

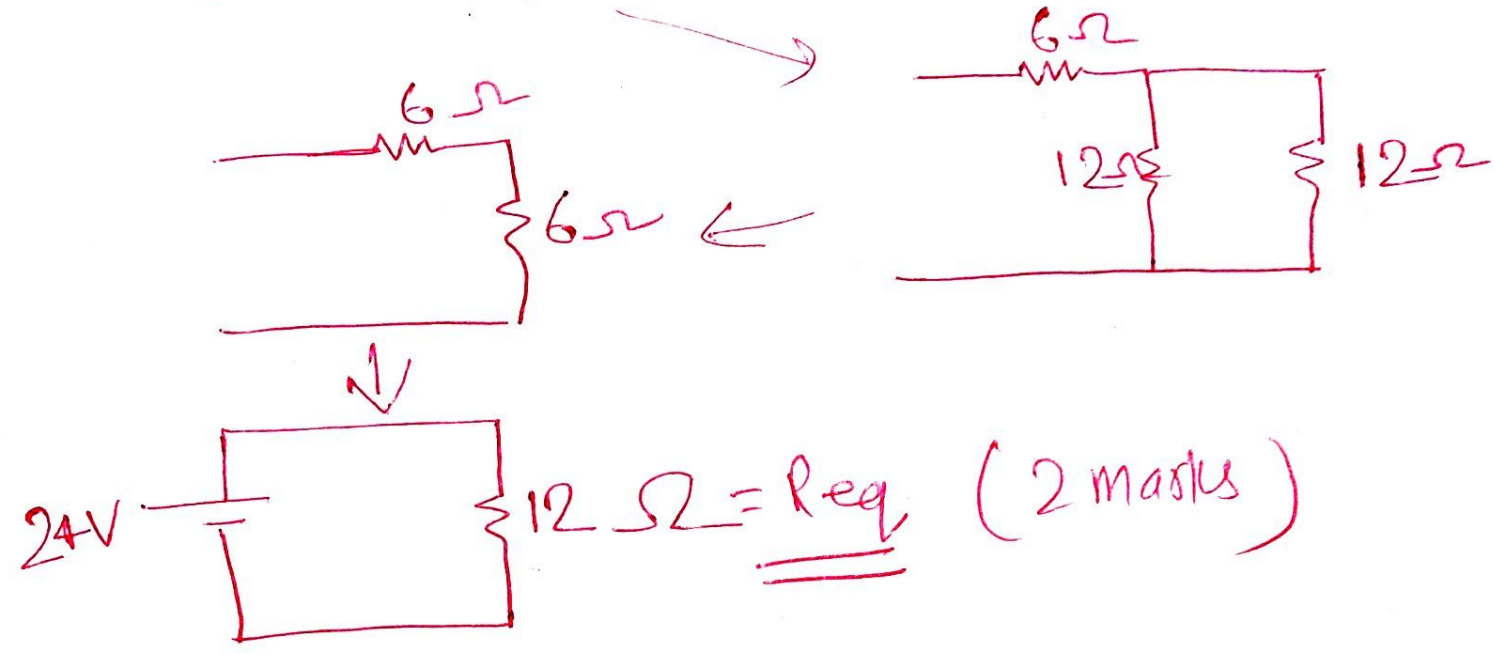
$$I_1 = \frac{70-24}{12} = \frac{46}{12} = 3.833\,A$$

Superposition

$$\frac{12 + 24 \times 56}{24 + 56} = 288$$

Q 4. Solution

$$\frac{1}{R_{eq}} = \frac{1}{6\Omega} + \frac{1}{12\Omega} = \frac{3}{12} = \frac{1}{4\Omega}$$



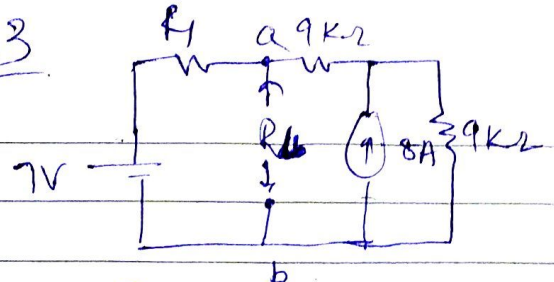
(2 marks)

$$I = 2\ A$$

$$P = 4 \times 12 = 48\ W$$

(2 marks

Q3



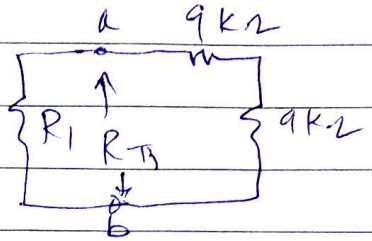
For max. power transfer

$R_L = R_{Th}$

~~18+9=27Ω~~

$R_L = 15\Omega$

For R_{Th}



$$\frac{R_1 \times 18}{18+R_1} = 3$$

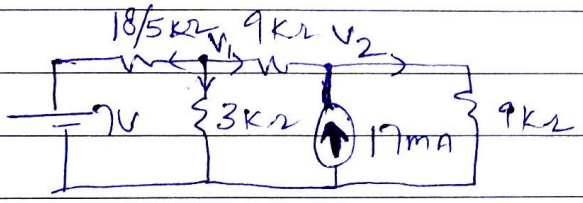
$$18R_1 = 54 + 3R_1$$

$$15R_1 = 54$$

$$R_1 = \frac{54}{15}\frac{18}{5} = \frac{18}{5}\ k\Omega$$

$$\frac{18}{5} = 3.6\ k\Omega = R_1$$

(2 marks)



3	3.6, 3, 9
	1.2, 1, 3

$$\frac{V_1-7}{3.6} + \frac{V_1}{3} + \frac{V_1-V_2}{9} = 0$$

$$\frac{3(V_1-7)+3.6V_1+1.2(V_1-V_2)}{10.8} = 0$$

$$3V_1 - 21 + 3.6V_1 + 1.2V_1 - 1.2V_2 = 0$$

$$7.8V_1 - 1.2V_2 = 21 \quad \text{---(1)}$$

$$\frac{V_1-V_2}{9} + 17 = \frac{V_2}{9}$$

$$\frac{V_1-V_2}{9} - \frac{V_2}{9} = -17$$

$$\frac{V_1-V_2-V_2}{9} = -17$$

$$V_1 - 2V_2 = -153 \quad \text{---(2)}$$

$$7.8V_1 - 15.6V_2 = -1193.4$$

$$7.8V_1 - 1.2V_2 = 21$$

$$-14.4V_2 = -1214.4$$

$$V_2 = 84.33$$

$$V_1 = 2V_2 - 153 = 2\times 84.33 - 153 = 15.66\ V$$

$$I_1 = \frac{15.66-7}{3.6} = \frac{8.66}{3.6}$$

$$I_1 = 2.41\ mA$$

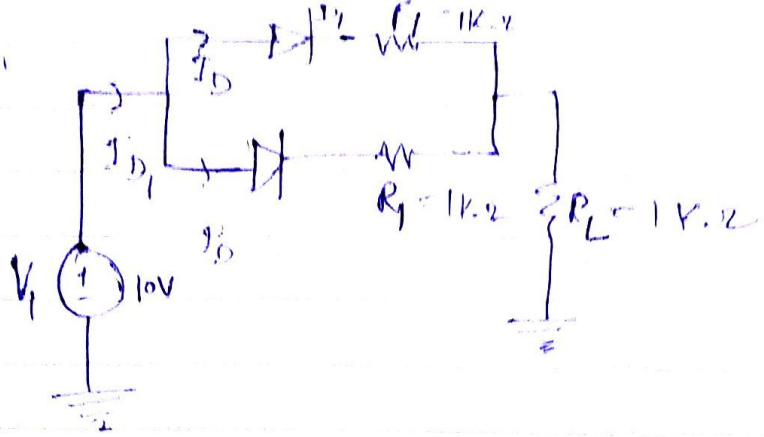
$$P = I_1^2 R_1 = 20.91\ mW$$

(3 marks) Ans

×7.8

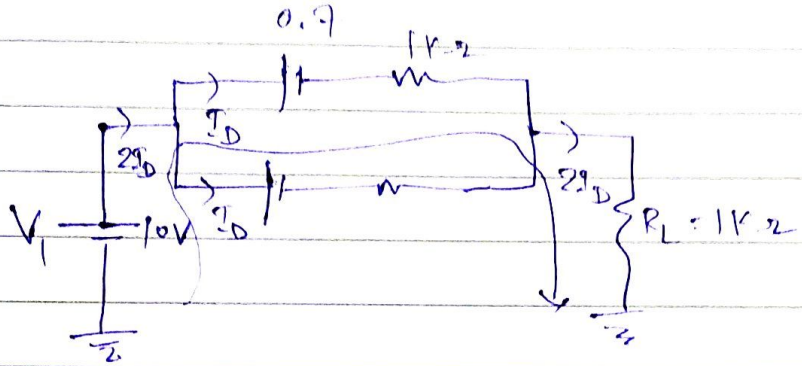
Students may apply superposition also

Q5.



$$I_D = \frac{I_{D_1}}{2} \quad \therefore \quad I_{D_1} = 2I_D \qquad \text{---(1)}$$

D_1 is F.B.



(1)

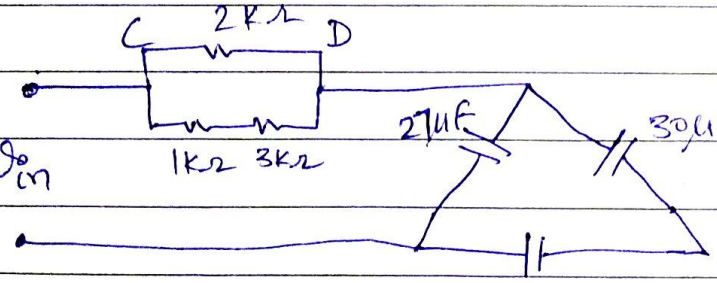
$$-10 + 0.7 + I_D + 2I_D = 0$$

$$3I_D = 10 - 0.7 = 9.3 \qquad \text{(2)}$$

$$I_D = \frac{9.3}{3} = 3.1\text{mA}$$

$$I_D = 3.1\text{mA}$$

Q6

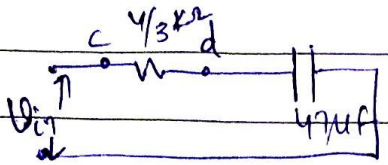


$$C_{eq} = 2 + \frac{30 \times 60}{30 + 60}$$

$$= 2 + \frac{1800}{90} = 20$$

$$C_{eq} = 4\mu F$$

$$R_{eq} = \frac{4K\Omega}{6} = \frac{4K}{3}$$



$$H(j\omega) = \frac{V_{op}}{V_{in}} = \frac{IR}{I\left(R + \frac{1}{j\omega C}\right)} = \frac{1}{1 + \frac{1}{j\omega RC}} \qquad (1) \quad (2)$$

$$H(j\omega) = \frac{1}{1 + \frac{1}{j\omega RC}}$$

$$|H(j\omega)| = \frac{1}{\sqrt{1 + \frac{1}{(\omega RC)^2}}}$$

$$|H(0)| = \frac{1}{\sqrt{1 + \frac{1}{0}}} = \frac{1}{\infty} = 0$$

$$|H(\infty)| = \frac{1}{\sqrt{1 + \frac{1}{\infty}}} = 1$$ — 1

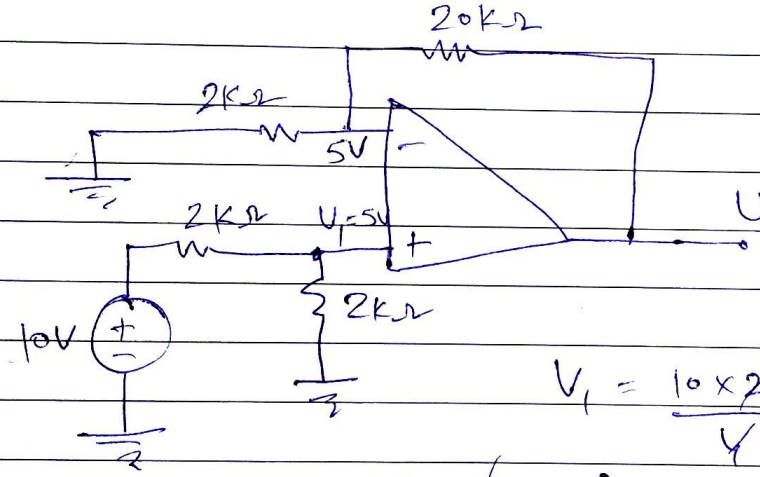
It is HPF.

$$f_c = \frac{1}{2\pi RC} = \frac{1}{2 \times 3.14 \times 4 \times 10^{-3} \times 47 \times 10^{-6}}$$

$$f_c = \frac{10^3}{393.55} = 2.541\ \text{Hz}$$ — 1

$$f_c = 2.541$$

7

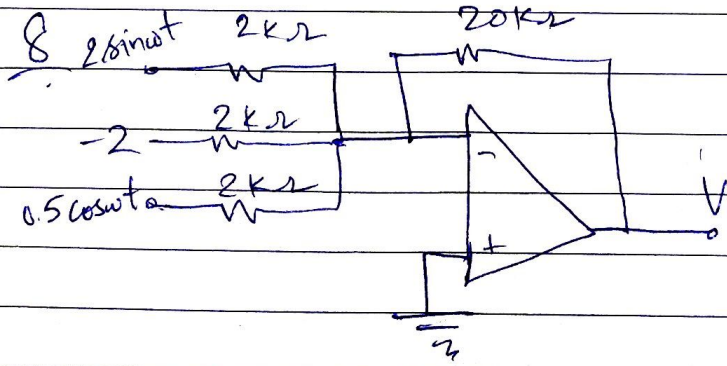


$$V_1 = \frac{10 \times 2}{4 \times 2} = 5V$$

$$V_o = \left(1 + \frac{R_f}{R_1}\right) \cdot V_1 = \left(1 + \frac{20}{2}\right) 5$$

$$V_o = 11 \times 5 = 55V.$$

8



$$V_o = -\frac{R_f}{R_1}(V_1 + V_2 + V_3)$$

$$= -\frac{20}{2}(2\sin\omega t - 2 + 0.5\cos\omega t)$$

$$V_o = -20\sin\omega t + 20 - 5\cos\omega t$$