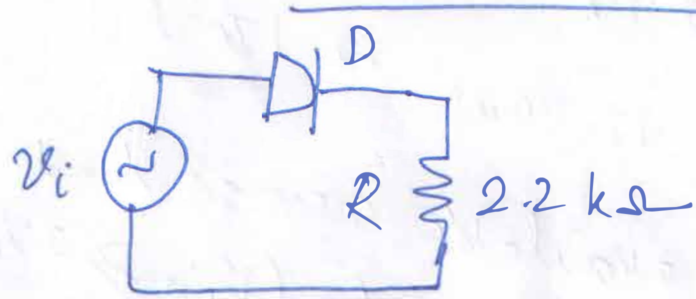
Solutions to Tutorial Sheet-13

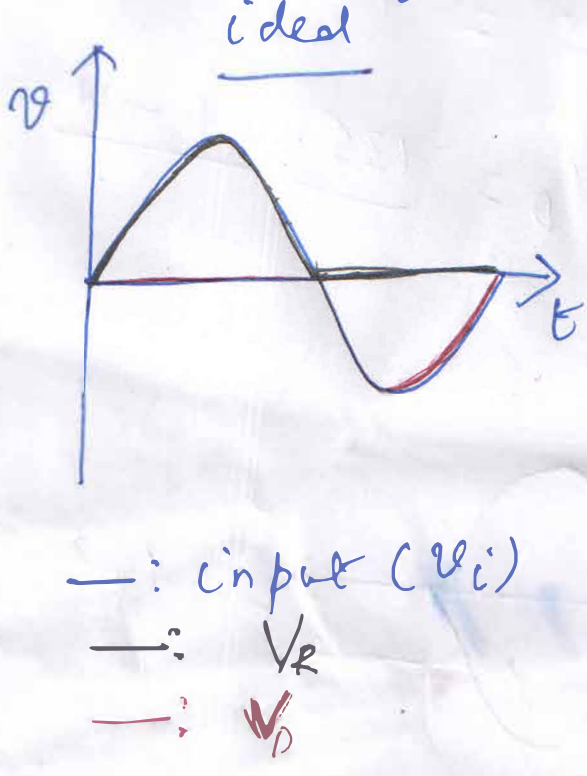
1.

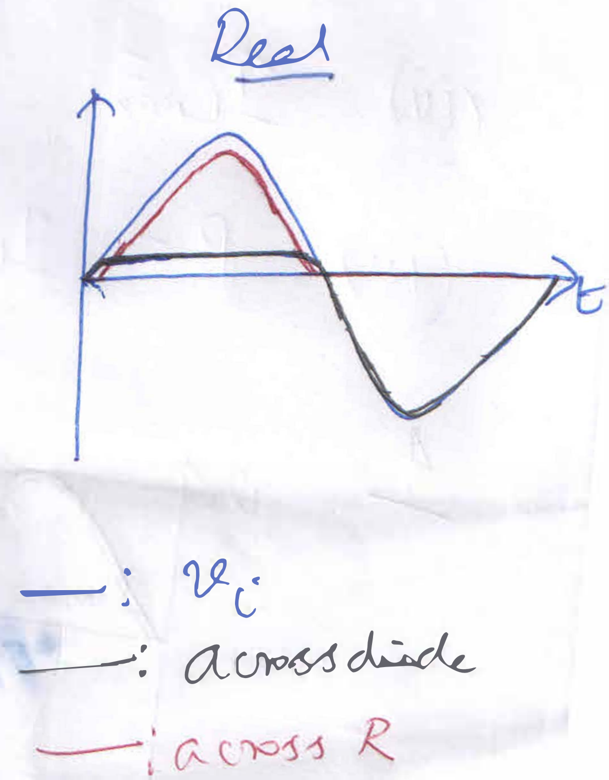


$v_i = 10\sin(\omega t)$
$f = 60\ Hz = \omega$

Ideal diode: no voltage drop in forward bias. So voltage drops across R
entire voltage drops across D in reverse bias.

Real diode, V_D is fixed at 0.7 V (for Si)
when $v_i \geq 0.7$ else $V_D = v_i$





2. Irrespective of v_i, $V_R = 2V$
(R is in parallel with 2V source)

3 $V_{RMS} = 120V$

$V_{peak} = \sqrt{2}\, V_{RMS} \sim 170V$

(i) Voltage available across load

$v_{in} - 2V_D$ for ($v_{in} \geq 2V_D$)

else 0

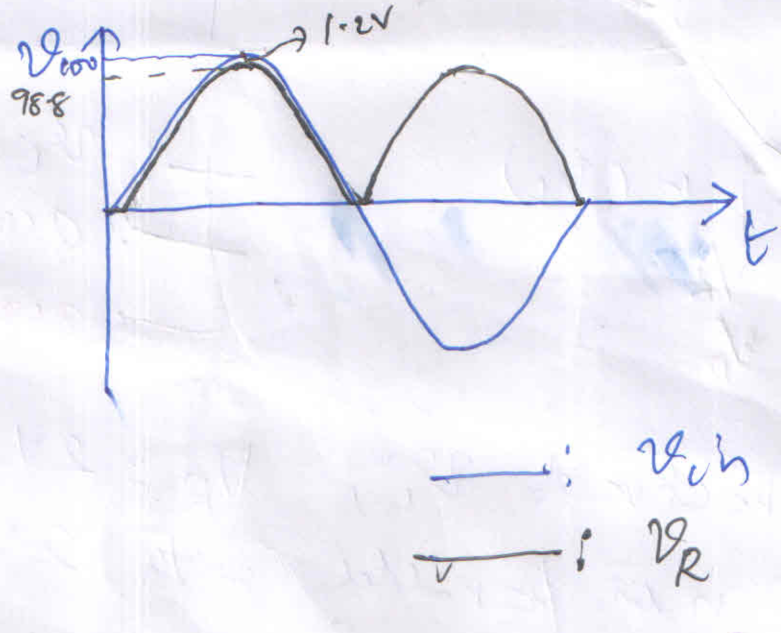
$V_{Lmax} = 170 - 2 \times 0.6 = 168.8V$

(ii) Each reverse biased diode should hold a maximum of $\frac{V_{Lmax}}{2} = \underline{84.4V}$ in reverse bias

(iii) $I_{Lmax} = \frac{V_{Lmax}}{R} = 168.8\,mA$ ($R = 1k\Omega$)

(iv) $P = I_{Lmax} \cdot V_D = \underline{135.04\,mW}$

4.



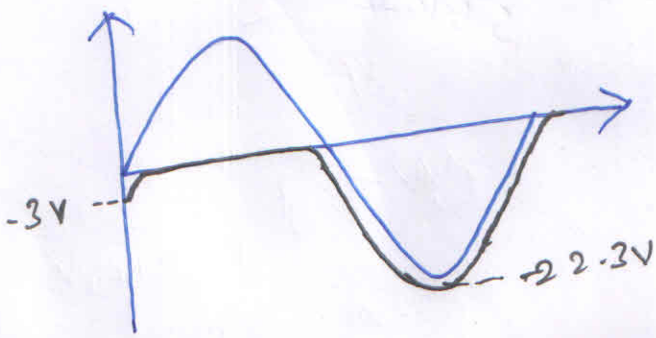
5 a) for $v_i \leq 3V$ battery ensures diode is forward bias. Hence voltage across diode is 0.7 V. $v_o = (v_i - 3)V$ (v_o is across R)

~~for~~ at $v_i = 3V$, $v_o = 0V$

at $v_i = -20V$, $v_o = -20 - 3 = -23V$

(considering real diode) ~~on~~

$v_o = v_i - 3 + V_D = -22.3V$



—: input

—: output

b) for positive pulse of v_i:

$v_o = 10 - 0.7 + 5 = \underline{14.3V}$

for negative pulse of v_i, as diode is off,

$v_o = \underline{0V}$

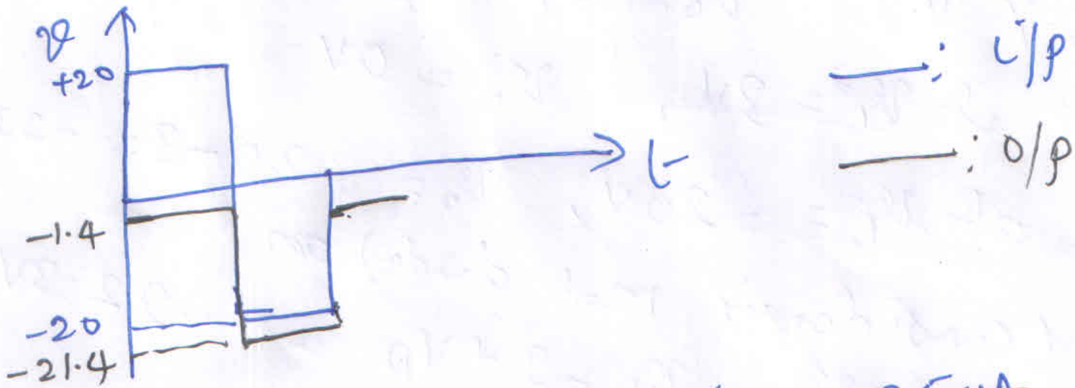
6 During positive pulse of v_i;

diode is "on" and $v_o = -2 + 0.6V = -1.4V$

Capacitor charges to $10 + 2 - 0.6 = 11.4V$

($\tau = RC = 5.6ms$. $5\tau = 28ms >> \frac{1}{f}$ (1ms))

In the negative pulse of v_i,
diode is off and $v_o = -10 - 11.4 = -21.4$



$$I_R = \frac{v_o}{R} = \frac{-1.4\,V}{56k\Omega} = \underline{25\,\mu A}$$