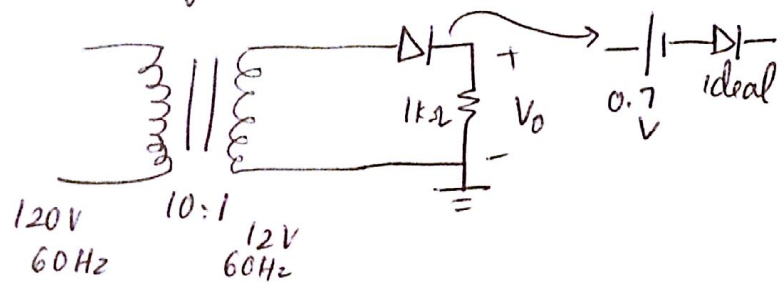
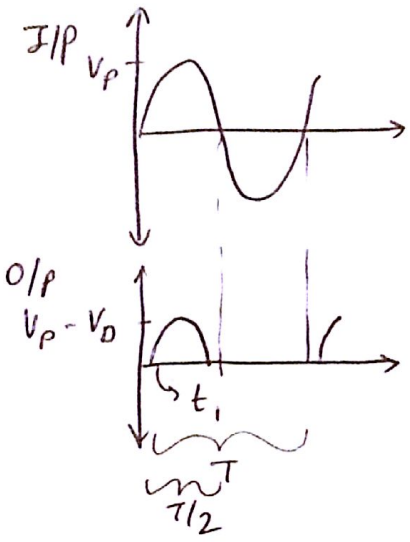
HOMEWORK #4

4.68 half-wave rectifier circuit



$V_p = 12\sqrt{2}$ V as $V_{rms} = 12$V
↳ of input

V_p of rectified voltage $= 12\sqrt{2} - 0.7$
$= 16.97 - 0.7$
$= 16.27$ V



The diode is on for $V_{i/p} > V_D$
i.e $V_p \sin\omega t > V_D$

from the graph
$t_1 = \frac{\left(\sin^{-1}\frac{V_D}{V_p}\right)}{\omega} = \frac{2.36}{\omega}$

Diode conducts for $T/2 - 2t_1$

$C = \frac{1}{2f}\left(1 - \frac{2\sin^{-1}(V_D/V_p)}{\pi}\right)$

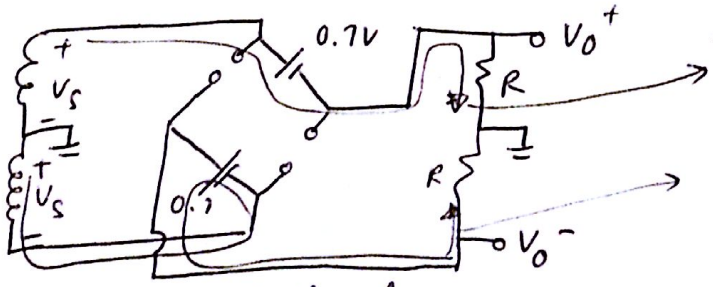
% it is ON $= \frac{C}{T} = Cf = \frac{1}{2}\left(1 - \frac{2\sin^{-1}(V_D/V_p)}{\pi}\right)$
$= 48.69\%$ //

Average o/p voltage $= \frac{1}{\pi}V_p - \frac{V_D}{2} = \frac{16.97}{5.05\pi} - \frac{0.7}{2} \simeq 4.9$ V

Average current through the load $= \frac{4.9}{1k\Omega} = \frac{4.9}{5.05}$ mA

4.74 +ve half cycle diodes D1 and D2 conduct
-ve D3 D4

Consider diode D1,D2 in +ve half cycle

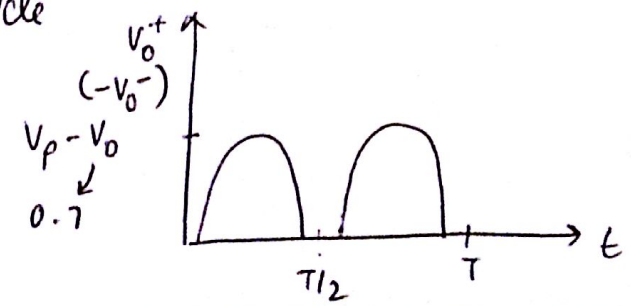


$\Rightarrow V_o^+ = V_s - 0.7$

$V_o^- = -V_s + 0.7$

III ly for -ve half cycle

$\Rightarrow$ Waveforms are like



Average output $v_o^+ = \langle v_s \rangle - 0.7$ → over T/2 period ⇒ ~ full wave rectifier

$= \frac{2}{\pi} V_p - 0.7$

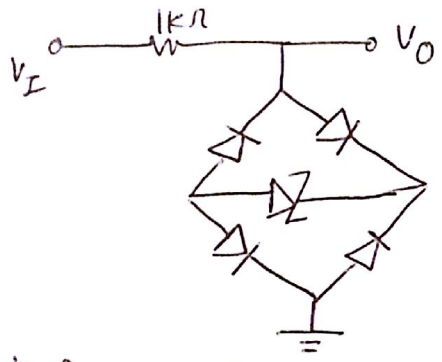
$\Rightarrow v_s = \frac{\pi}{2}(\bar{v}_o^+ + 0.7)$ Given $\bar{v}_o^+ = \bar{v}_o^- = 15V$

or $V_p = \pi/2\,(15.7) = 24.7V$

Consider the +ve half cycle, D_2 and D_4 in RB

Inverse voltage $= v_s + v_o = 2v_s - v_o = 2v_s - 0.7 = 48.7V$ //

4.88 $-20V \le V_I \le 20V$



$V_O = 0.7V$

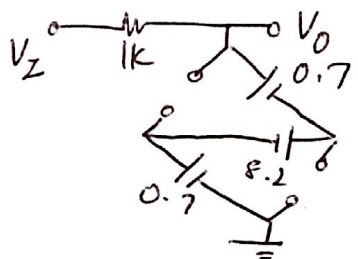
$V_Z = 8.2V$

For $V_I > 0$ & $V_I < (0.7 + 8.2 + 0.7)V$ → 9.6

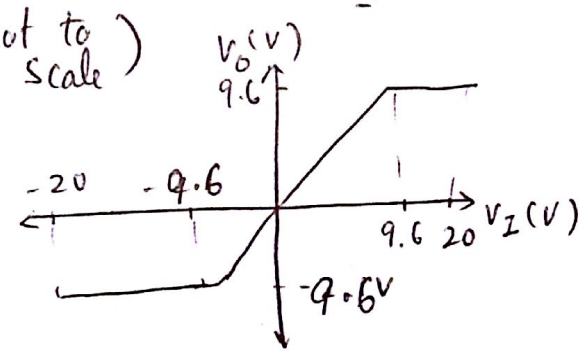
⇒ $V_I = V_O$

& $V_I > 9.6V$

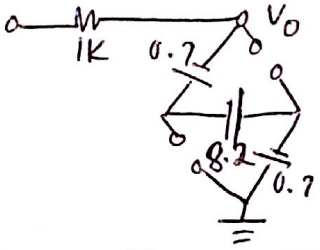
$V_O = 9.6V$



(not to scale)



For $V_I < 0$ & $V_I > -9.6V$



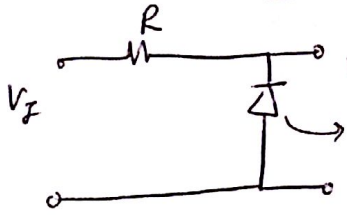
⇒ $V_O = V_I$

V_I & $< -9.6V$

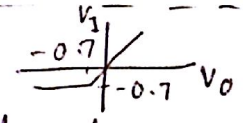
⇒ $V_O = -9.6V$

4.90 (a) $-0.7V$ and above →

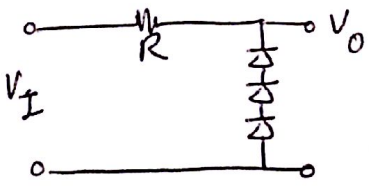
$R = 10K\Omega$

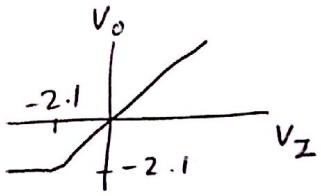


each a drop of 0.7V



(b) $-2.1V$ and above →





(c) $\pm 1.4V$ →