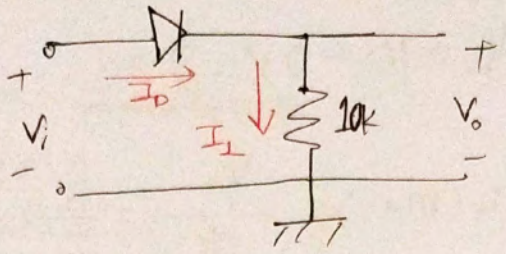
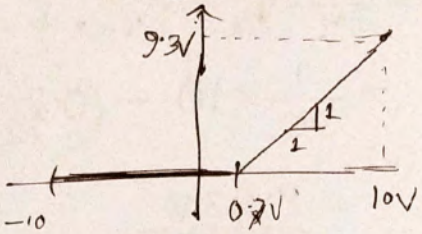
① Half wave rectifier:



(a) Given $V_\gamma = 0.7V = V_{D0}$

(a) Sketch the voltage transfer characteristics for $-10V \le V_i \le 10V$

Soln:



(b) For $v_i = 10\sin(240\pi t)$, find

(i) Peak output voltage.

(ii) Peak diode current.

(iii) Output frequency.

(iv) Average value of output voltage.

(v) Sketch the output and input voltage.

Soln: (i) $V_M = 10V$

$\therefore V_p = V_M - V_{D_0} = 10 - 0.7 = 9.3V$

(ii) $I_{D(max)} = I_{(max)} = \frac{V_p}{10K} = 0.93mA$ ~~9.3mA~~

(iii) $f_i = \frac{\omega_s}{2\pi} = \frac{240\pi}{2\pi} = 120\,Hz$

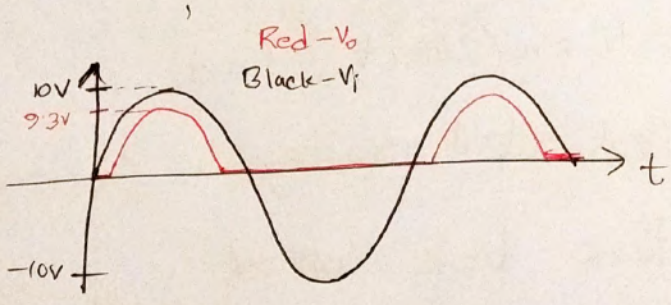
$\therefore f_o = f_i = 120\,Hz$

(iv) $V_{DC} = V_{AVG} = \frac{1}{\pi} V_M - (V_D/2)$

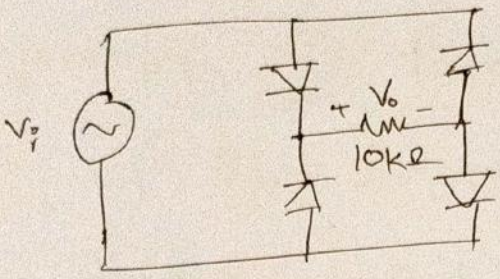
$= \frac{1}{\pi} \times 10 - (0.7/2)$

$= 2.83V$

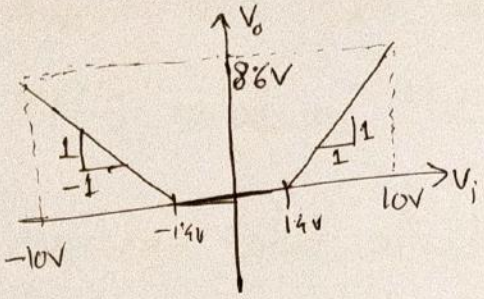
(v)



② Repeat problem 1 for the following full wave rectifier



Soln ⓐ



ⓑ (i) $V_M = 10V$

$\therefore V_p = V_M - 2V_{D_0} = 8.6V$

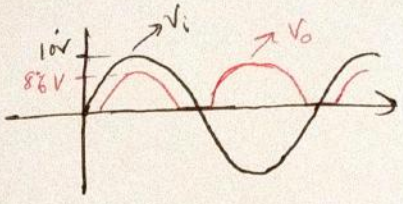
(ii) $I_{D(max)} = I_{(max)} = \frac{V_p}{10K} = 0.86\,mA$

(iii) $f_i = 120Hz$

$\therefore f_o = 2f_i = \underline{240Hz}$

(iv) $V_{DC} = V_{AVG} = \frac{2}{\pi} V_M - 2V_{D_0} = \underline{4.92V}$

(v)



(3) If a capacitor $C = 100\,\mu F$ is connected in parallel with the resistance in problem (1), find

(a) Ripple frequency.

(b) Peak-to-Peak ripple voltage

(c) R.M.S value of the ripple voltage

(d) Average value of the output voltage

(e) ripple factor

Soln:

(a) $f_i = 120\,Hz. \quad \therefore f_r = f_i = 120\,Hz.$

(b) $V_{r(p-p)} = \dfrac{V_p}{f_r RC} = \dfrac{9.3}{(120) \times (10 \times 10^3 \times 100 \times 10^{-6})}$

$= 0.0775\,V$

(c) $V_r(rms) = \dfrac{V_{r(p-p)}}{2\sqrt{3}} = \dfrac{0.0775}{2\sqrt{3}} = 0.022\,V$

(d) $V_{AVG} = V_{DC} = V_p - \dfrac{V_{r(p-p)}}{2} = 9.3 - \dfrac{0.0775}{2} = 9.26\,V$

(e) $r = \dfrac{V_r(rms)}{V_{DC}} = 0.0023$

④ Repeat problem ③ for the full wave rectifier in problem ②.

Soln: ⓐ $f_p = 2f_i = 240\,Hz$

ⓑ $V_{p(p-p)} = \frac{V_p}{f_p RC} = \frac{8.6}{(240)(10\times10^{3})(100\times10^{-6})}$

$= 0.0358\,V$

ⓒ $V_{p(rms)} = \frac{V_{p(p-p)}}{2\sqrt{3}} = 0.0103\,V$

ⓓ $V_{DC} = V_{AVG} = V_p - \frac{V_{p(rms)}}{2}$

$= 8.6 - \frac{0.0358}{2}$

$= 8.5821\,V$

ⓔ $r = \frac{V_{p(rms)}}{V_{DC}} = \frac{0.0103}{8.5821} = 0.0012$