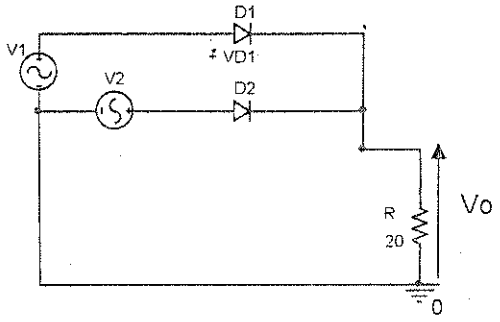
Birzeit University
Electrical and Computer Engineering Department
Power Electronics 3305
Quiz # 2

Student Name: _____ ID: _____

Question #1 In the circuit shown below, the $V_1=8\sin 100\pi t$V and $V_2=8\sin(100\pi t-180)$V, and the diodes are **non ideal with a voltage drop of 1V** then:

a) Using the waveforms shown, draw the output voltage



b) **Calculate** the average output voltage

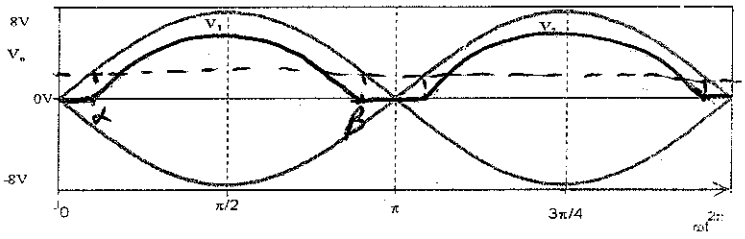
1 diode conducting

$1V = 8\sin\alpha \Rightarrow \alpha = \sin^{-1}\frac{1}{8}$

$\alpha = 7.2$

$\alpha = \frac{7.2}{180}\cdot\pi$

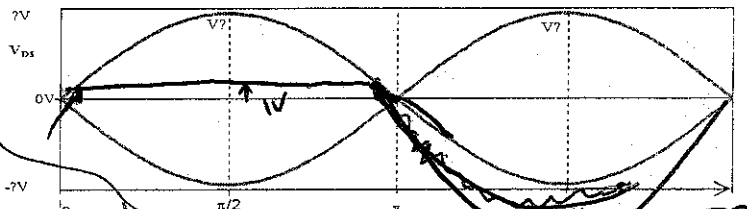
$\Rightarrow \alpha = 0.04\pi$, $\beta = \pi - 0.4\pi = 0.96\pi$ or 172.8



$$V_{dc} = \frac{2}{2\pi}\int_{\alpha}^{\beta}(V_m\sin\omega t - 1)\,d\omega t$$

$$= \frac{1}{\pi}\int_{0.04\pi}^{0.96\pi}(V_m\sin\omega t - 1)\,d\omega t$$

c) Plot the voltage across D_1



$$= \frac{1}{\pi}\left[-V_m\cos\omega t\Big|_{0.04\pi}^{0.96\pi} - 0.96\pi + 0.04\pi\right)$$

$$= -\frac{8}{\pi}\left[\cos 0.96\pi - \cos 0.04\pi\right] - 0.92\pi)$$

$$= -\frac{8}{\pi}\left[-0.992 - 0.992\right] - (2.89) = \frac{-8}{\pi}(-1.984) - 2.89$$

$$\Rightarrow V_{dc} = +5.052 - 2.89 = 2.162\text{V}$$

$V_{dc} = 2.162\text{V} < \frac{2V_m}{\pi}$

$V_{dc} = 2.162 < 5.093\text{V}$!

$V_{dc} = V_1 - V_2 + 1$

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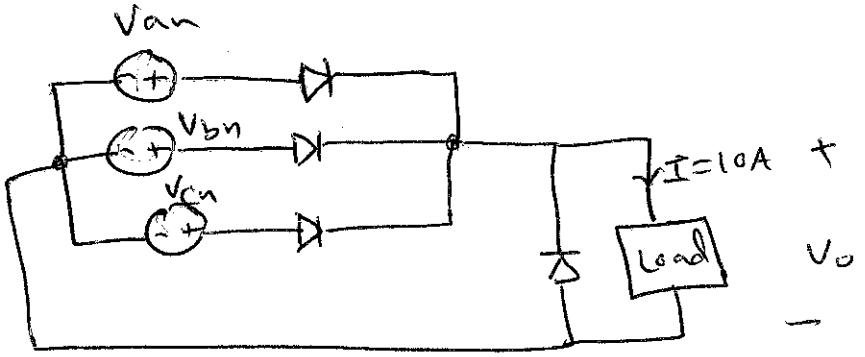
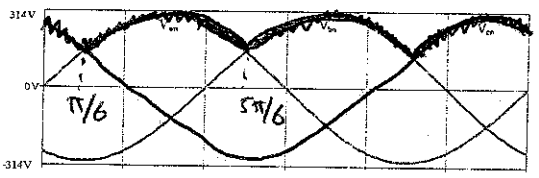
Question # 1

a) Draw the circuit arrangement of a three phase half- wave rectifier supplying a highly Inductive load by 10A.



b) Assuming ideal diodes, **plot** the output voltage and **calculate** its average if $V_{an}=314\sin 100\pi t V$.

$$V_{dc}=\frac{3}{2\pi}\int_{\pi/6}^{5\pi/6} 314\sin 100\pi t\, d\omega t$$



$$= \frac{2V_m}{\pi}\sin\frac{\pi}{2} = \frac{3(314)}{\pi}\sin\frac{\pi}{3} = \frac{3(314)}{\pi}\left(\frac{\sqrt{3}}{2}\right) = 259.67V$$

c) Assuming that a freewheeling diode is connected across the load, plot the input current from Phase a "i_a"