Introduction to Electronics

Mid-Term Exam #1

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Important parameters of the devices used in **Figure 1** are as follows:

- Resistors : R_X=**1.5kΩ** , R_Y=**3.3kΩ**
- For **all** diodes (D_1,D_2,D_3,D_4) : I_S=**5.10^{-15}A** , $P_{d,max}$=**75mW**
- For the Zener diodes D_3 and D_4 : V_{Zk}=**4.7V** , I_{Zmin}=**0.3mA** , r_z=**7Ω**
- V_T=**25.9mV** [T=300K]

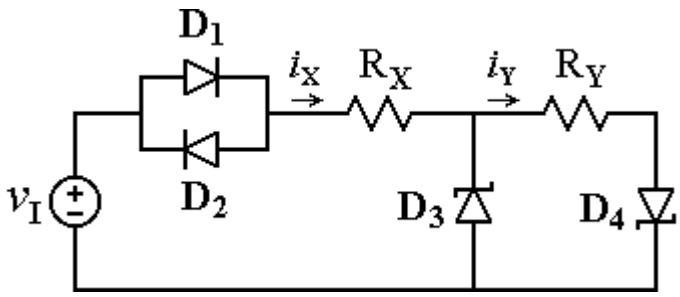

Figure 1

NOTE: Use r_z only in small signal analysis.

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a) By making use of the **constant voltage drop** model (with V_{D0}=**0.6V**) for the **forward-biased** diodes, determine the range for v_I along which D_3 operates securely in Zener region (Name the limits of the range as $V_{I,min}$ and $V_{I,max}$). **[*20p*]**

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b) By using the **accurate model** "$i_D=I_S(e^{v_D/V_T}-1)$" for the diodes (except for the Zener region), determine the currents i_X and i_Y for each of the input voltage values below:

i) v_I=**3V** , **ii)** v_I=**9V** , **iii)** v_I=**-3V** , **iv)** v_I=**-9V** **[*40p*]**

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c) If the input voltage v_I is as shown in **Figure 2**, use **small signal** approximation and the corresponding **DC** diode currents found in **(b)** to draw the waveforms of the currents i_X and i_Y. **[*40p*]**

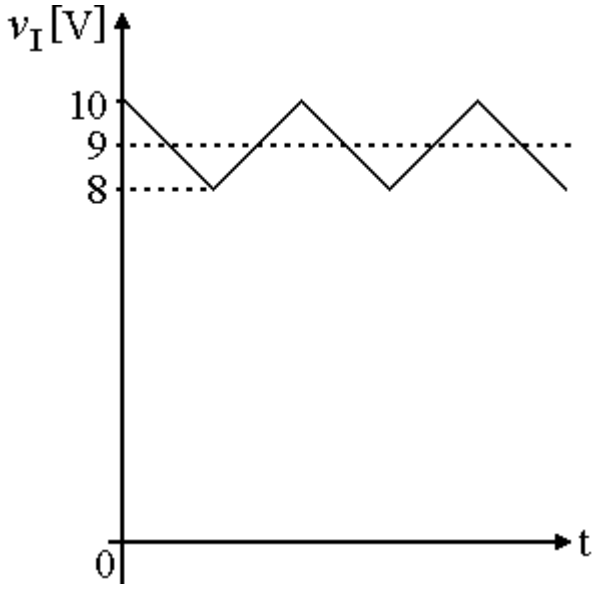

Figure 2

Note for (c): If you **couldn't** obtain the required **DC** diode currents in **(b)**, then you can still obtain them by using the **constant voltage drop** model, **BUT** you will get less points from **(c)** ☹.

GOOD LUCK