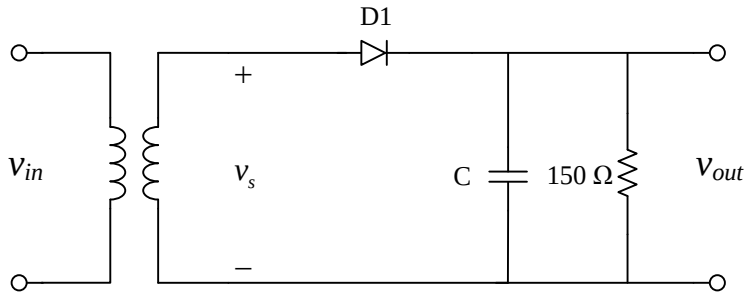
In the Name of Allah, the Most Beneficent, the Most Merciful.

Electronics 1, Assignment #4, Applications of Diode.

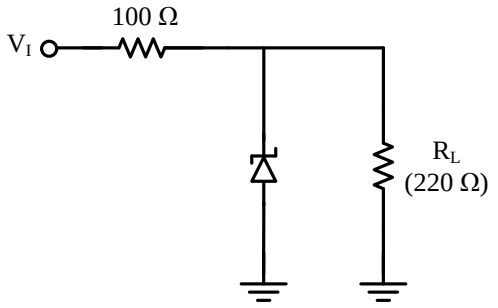
Due: Farvardin, 23th

Shahrood University of Technology

1. Let us design a power supply with the following specifications: The average value of the output voltage should be 15 V with a maximum ripple of 2 V. The input voltage and the output load are supposed to be the AC power line (a sinusoidal signal with an amplitude of 310V and a frequency of 60 Hz) and a resistive load of 150 Ω, respectively.
   Determine the value of the capacitor (*C*), the turns-ratio (*n*), and the maximum reverse voltage (PIV) that the diode should tolerate.

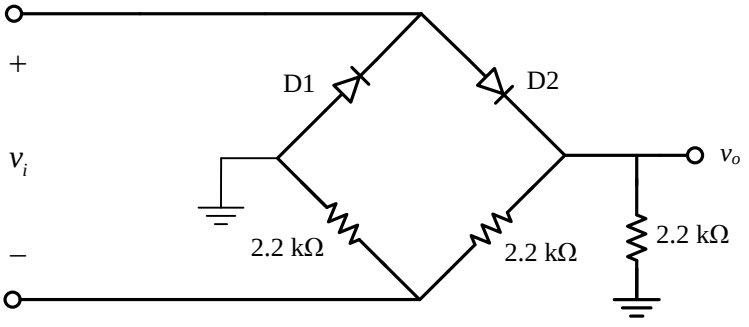


2. In the following circuit, determine the input voltage range for which the voltage across R_L remains 6.1 V.

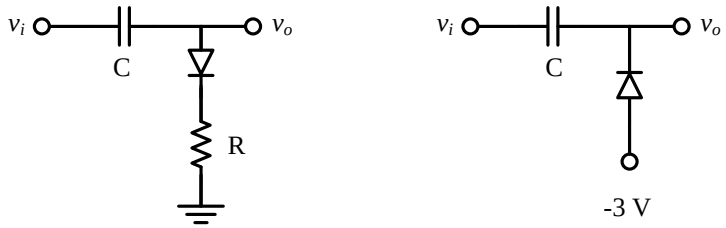


$$\begin{cases} V_Z = 6.1V \\ I_{ZK} = 1mA \\ P_{Z\max} = 500mW \end{cases}$$

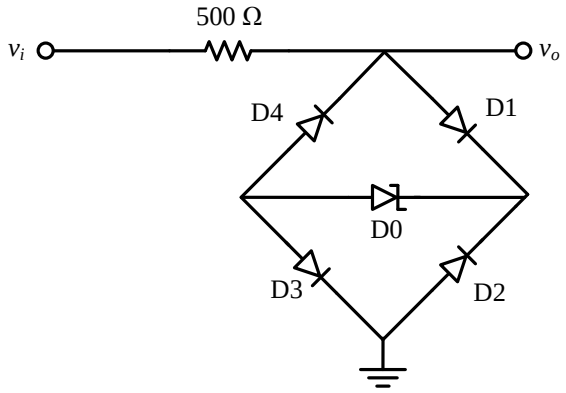
3. A sinusoidal voltage with an amplitude of 40 V is applied to the circuit shown below. Plot the output voltage for a single cycle. Determine PIV of the diodes.



4. The input of the following circuit is supposed to be a rectangular signal with an amplitude of ±10 V. plot the output voltage. Suppose that R×C is much longer than the input voltage period.

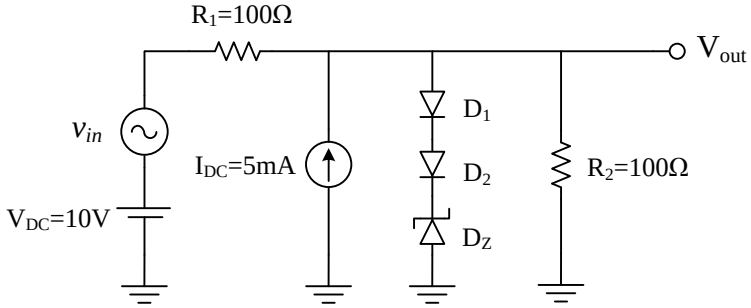


5. a) Plot the input-output characteristic for the following circuit as the input voltage increases from -20 V to +20 V.
b) Consider the input voltage is a series combination of a 15 V DC voltage source and a sinusoidal voltage source with an amplitude of 10 mV. If the dynamic resistance of the normal diodes and the zener diode are equal to 20 Ω and 10 Ω, respectively, determine the output voltage (Hint: use small-signal model)



$$\begin{cases} V_Z = 10V \\ V_{D,ON} = 0.7V \end{cases}$$

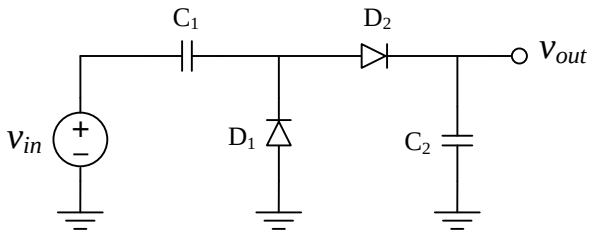
6. Determine the output voltage in the following circuit and plot it as a function of time. Diodes, D_1 and D_2, are supposed to be on, while the zener diode is in the reverse breakdown region. Suppose that the dynamic resistance of the zener diode ($r_{d,z}$) is 1 Ω and the input small-signal voltage source has an amplitude of 10 mV.



$$\begin{cases} V_{D,ON} = 0.7V \\ V_Z = 3.6V \\ r_{d,z} = 1\Omega \\ V_T = 25mV \\ v_{in} = 0.01\sin \omega t \quad V \end{cases}$$

7. Design a Clamper (limiter) circuit which limits the input voltages above 15 V and below 7 V. Only 6.3-V and 5.4-V zener diodes as well as 0.8-V normal diode are available.

8. Consider a sinusoidal signal as the input voltage of the following circuit. Prove that the circuit is a kind of multiply-by-two circuit, i.e., after several cycles, the output voltage will be a constant voltage with a value which equals two-times of the input voltage amplitude. Consider ideal diodes.



Good luck – M.R. Ashraf