

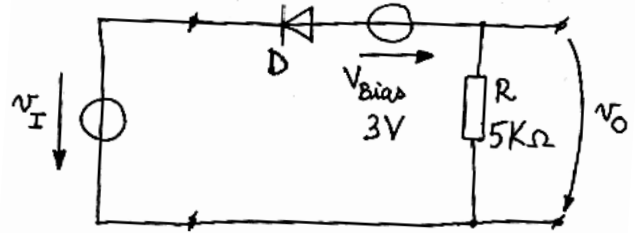
SEMINAR 2

Contents:

- Circuits with diodes
- Voltage Rectifiers

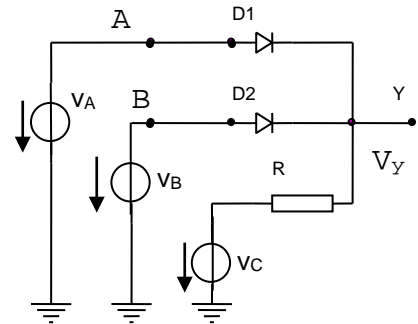
1. Consider for D - constant voltage drop model, $v_D=0.7V$.

- a) Derive and plot the VTC $v_O(v_I)$ of the circuit, for $v_I \in [-20V; 20V]$.
- b) What is the maximum value for v_I to have a non-zero output value v_O ?
- c) Plot $v_O(t)$ for $v_I(t) = 5\sin\omega t$ [V]. What is the application of the circuit?
- d) $V_{Bias}=0$. A capacitor C is connected in parallel to R . Assume $v_I(t) = 5\sin\omega t$ [V] Replot, qualitatively, $v_O(t)$.



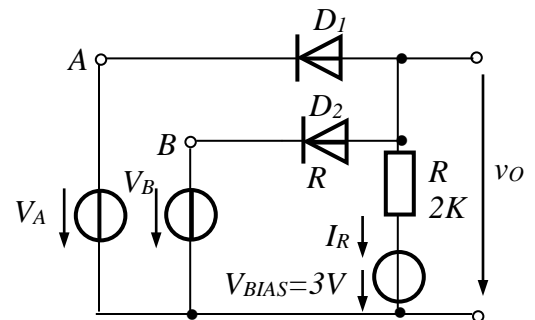
2. Consider for D_1 and D_2 - constant voltage drop model, $v_D=0.7V$.

- a) Find the expression $v_Y(v_A, v_B, v_C)$.
- b) Plot $v_Y(t)$ if $v_C(t)=0$; $v_A(t)=2V$; $v_B(t)=5\sin\omega t$ [V]. Mention the states (on, off) for D_1 and D_2
- c) For $v_C=0V$; $v_A, v_B \in \{0V; 10V\}$; assuming the logic convention: 0V-“0” logic, 10V-“1” logic, fill the truth table $Y(A,B)$ and find the logic function of the circuit .



3. Assume for D_1, D_2 - constant voltage drop model, $v_D=0.7V$.

- a) What is the expression of $v_O(v_A, v_B)$? Determine the value of v_O , the current i_R , the states of D_1 and D_2 and the voltages on D_1 and D_2 for $v_A = -2V$ and $v_B = 8V$. Draw the circuit's model in this case.
- b) Is it possible to use this circuit as a logic circuit with the inputs A and B , considering the following voltage levels: 0V – “0”, 10V – “1”? Where should be the output Y of the logic circuit? Find the suitable value of V_{Bias} to use the circuit as a logic circuit with these voltage levels and give the logic table of the circuit with inputs A, B and output Y .



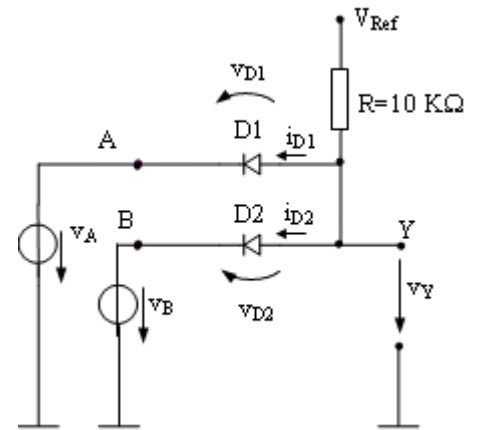
4. Consider for D1, D2 – constant voltage drop model, $v_D=0.7V$.

a) Find the expression of $v_Y(v_A, v_B, V_{Ref})$.

b) For $v_A, v_B \in \{0V; 10V\}$ and $V_{Ref}=10V$, fill in the voltage table and states of D1, D2 for all combinations of values of v_A and v_B . What is the logic function of the circuit assuming the logic convention: 0V-“0” logic, 10V-“1” logic?

c) Find the values of i_{D1} , i_{D2} and v_{D1} , v_{D2} for each of the 4 combinations of voltages v_A , v_B from (b).

d) For $V_{Ref}=0V$, propose some waveforms for v_A , v_B to use this circuit as a full-wave voltage rectifier. What is the sign of the d.c. component of the output voltage v_Y ?



5. Consider $v_I(t)$ a sine wave, 30V amplitude and 50Hz frequency.

a) How does $v_I(t)$, $v_O(t)$, and the current through D_1 look like?

b) What is the maximum value of the current through D_1 ?

c) Consider that a capacitor C is connected at the output (between A and B points). What should be the value of the capacitor so that the output ripple $\Delta v_o < 2V$?

