

Total time for Problem 4 and 5: 35 Minutes. **UPLOAD the answer 4 and 5 till 20.10!**

Group 1 (Student last number: 0,1,2,3) (G2 and G3 problems are in the next pages)

EHB 262E Final Exam

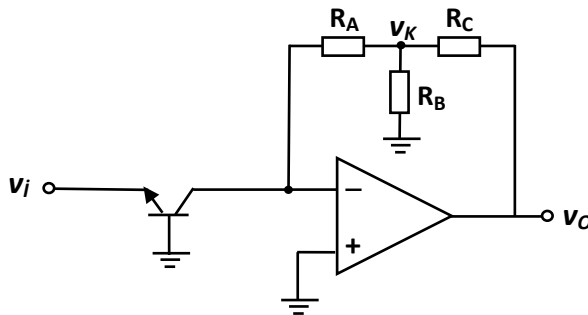
Group 1-Problem 4

18 June 2021

In the circuit below, the operational amplifier is ideal with the output voltage limitations $V^+ = 10V$ and $V^- = -10V$. Neglect the Early effect ($V_A = \infty$).

- Derive an expression for v_K in terms of v_i . $v_K = f(v_i)$?
- Derive an expression for v_O in terms of v_i ($v_O = f(v_i)$), and calculate it.
- For the v_i input voltage varying in the range $[-2V, +2V]$, draw the voltage transfer characteristic v_O versus v_i specifying the important voltage values on the plot. Every numerical value on the plot should be explained in detail on your answer sheet.

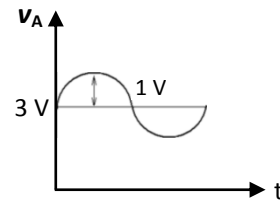
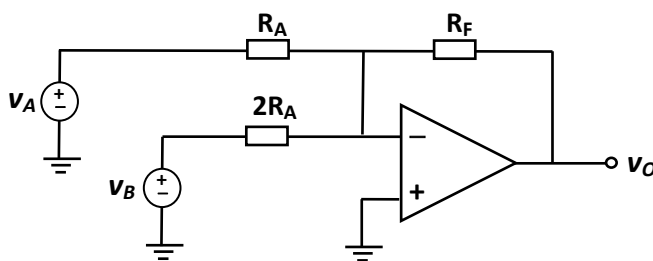
$R_A = 7\text{ k}\Omega$, $R_B = 1\text{ k}\Omega$, $R_C = 7\text{ k}\Omega$, saturation current of the transistor $I_S = 1 \times 10^{-16}\text{ A}$, and $V_T = 25\text{ mV}$.



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Group 1-Problem 5

In the circuit below, the operational amplifier is ideal with the output voltage limitations $V^+ = 12V$ and $V^- = -12V$. If v_A and v_O voltage waveforms are as shown in Figures (a) and (b), find the resistor values and the v_B signal. You can choose the resistor values in the range $[1\text{ k}\Omega, 50\text{ k}\Omega]$.



Figure(a)

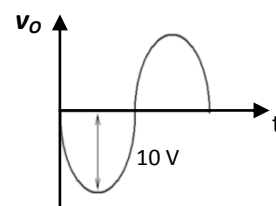


Figure (b)

Total time for Problem 4 and 5: 35 Minutes. **UPLOAD the answer 4 and 5 till 20.10!**

Group 2 (Student last number: 4,5,6) (G3 problems are in the next page)

EHB 262E Final Exam

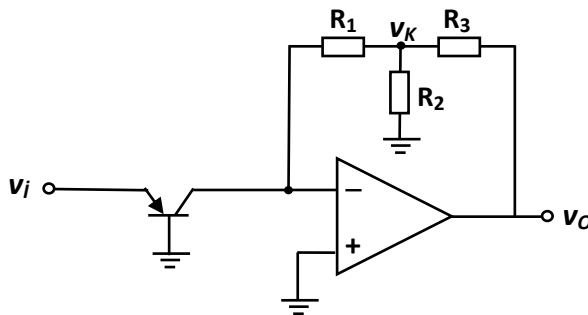
Group 2-Problem 4

18 June 2021

In the circuit below, the operational amplifier is ideal with the output voltage limitations $V^+=5V$ and $V^-=-5V$. Neglect the Early effect ($V_A=\infty$).

- Derive an expression for v_K in terms of v_i . $v_K = f(v_i)$?
- Derive an expression for v_O in terms of v_i ($v_O = f(v_i)$), and calculate it.
- For the v_i input voltage varying in the range $[-2V, +2V]$, draw the voltage transfer characteristic v_O versus v_i specifying the important voltage values on the plot. Every numerical value on the plot should be explained in detail on your answer sheet.

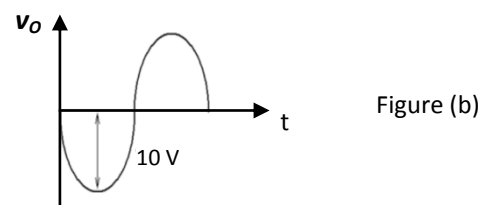
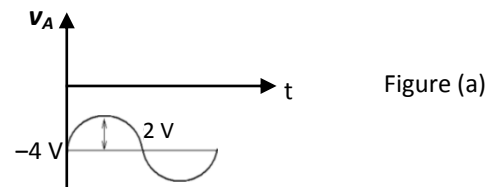
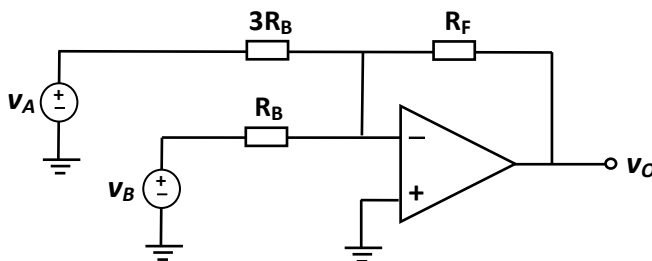
$R_1 = 10\text{ k}\Omega$, $R_2 = 2\text{ k}\Omega$, $R_3 = 10\text{ k}\Omega$, saturation current of the transistor $I_S = 1 \times 10^{-16}\text{ A}$, and $V_T = 25\text{ mV}$.



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Group 2-Problem 5

In the circuit below, the operational amplifier is ideal with the output voltage limitations $V^+=15V$ and $V^-=-15V$. If v_A and v_O voltage waveforms are as shown in Figures (a) and (b), find the resistor values and the v_B signal. You can choose the resistor values in the range $[1\text{ k}\Omega, 50\text{ k}\Omega]$.



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Group 3 (Student last number: 7,8,9)

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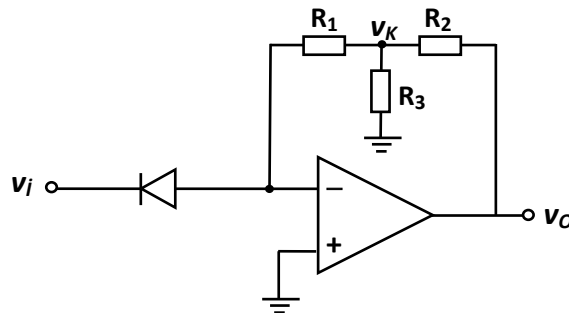
Group 3 -Problem 4

18 June 2021

In the circuit below, the operational amplifier is ideal with the output voltage limitations $V^+=12\text{V}$ and $V^-=-12\text{V}$. Neglect the Early effect ($V_A=\infty$).

- Derive an expression for v_K in terms of v_i . $v_K = f(v_i)$?
- Derive an expression for v_O in terms of v_i ($v_O = f(v_i)$), and calculate it.
- For the v_i input voltage varying in the range $[-2\text{V} +2\text{V}]$, draw the voltage transfer characteristic v_O versus v_i specifying the important voltage values on the plot. Every numerical value on the plot should be explained in detail on your answer sheet.

$R_1 = 8\text{ k}\Omega$, $R_2 = 8\text{ k}\Omega$, $R_3 = 2\text{ k}\Omega$, saturation current of the diode $I_S = 1 \times 10^{-15}\text{ A}$, and $V_T = 25\text{mV}$.



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Group 3-Problem 5

In the circuit below, the operational amplifier is ideal with the output voltage limitations $V^+=10\text{V}$ and $V^-=-10\text{V}$. If v_A and v_O voltage waveforms are as shown in Figures (a) and (b), find the resistor values and the v_B signal. You can choose the resistor values in the range $[1\text{k}\Omega \text{ } 50\text{k}\Omega]$.

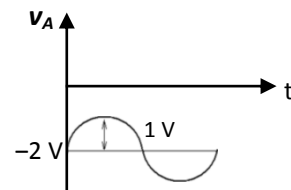
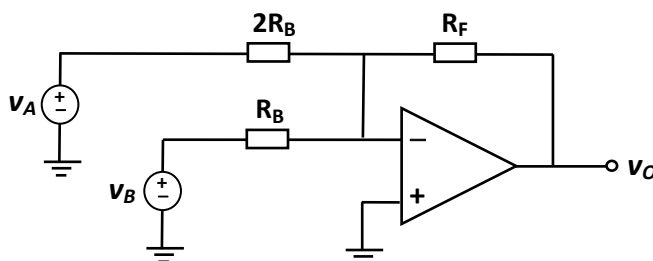


Figure (a)

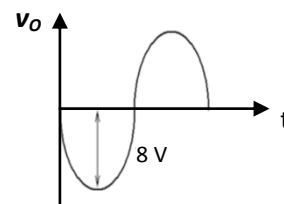


Figure (b)