Home Assignment 4, IE1206 & IF1330, VT2020

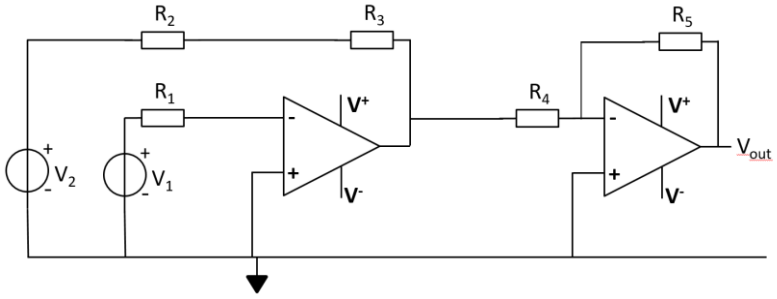
Problem 1

Per-Erik connected a load resistor R_L to a battery rated to be 9V. He measured the voltage (V_L) over the load resistor for different values of R_L. The measured data is shown in the table below.

R_L	100 kΩ	10 kΩ	1 kΩ	177 Ω	38 Ω
V_L	9.16	9.15	9.01	8.58	7.28

Determine the Thevenin equivalent of the 9V battery.

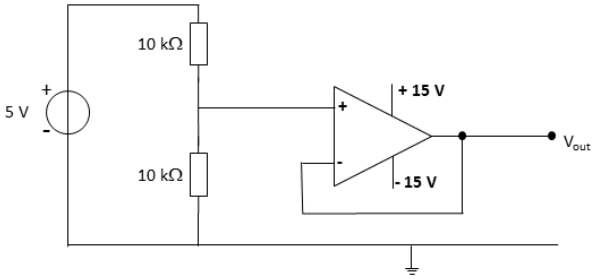
Problem 2



A) Determine the output voltage V_{out} as as function of V_1,V_2, R_1, R_2, R_3, R_4 and R_5. Assume the operational amplifiers are ideal and operates in the linear region.

B) Determine V_{out} if V_1=2 V, V_2=3 V and R_1=R_2=R_3=R_4=R_5=2 kΩ.

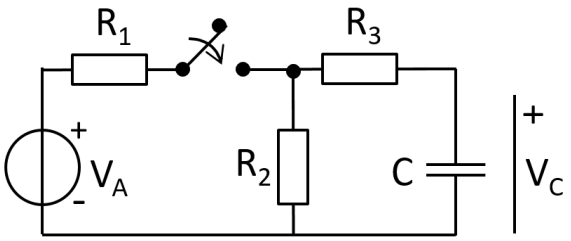
Problem 3



(A) Determine the output voltage V_{out} assuming that the op-amp operates in the linear region and is ideal.

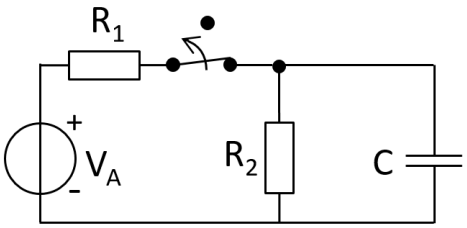
(B) What is the function of the op-amp (think about the op-amp input resistance)? What function does the circuit perform?

Problem 4



The switch has been open for a long time. At time t=0 s the switch closes. Determine the voltage over the capacitor V_C at time t=2 ms. V_A=6 V, R_1=R_2=10 kΩ, R_3=5 kΩ and C=100 nF.

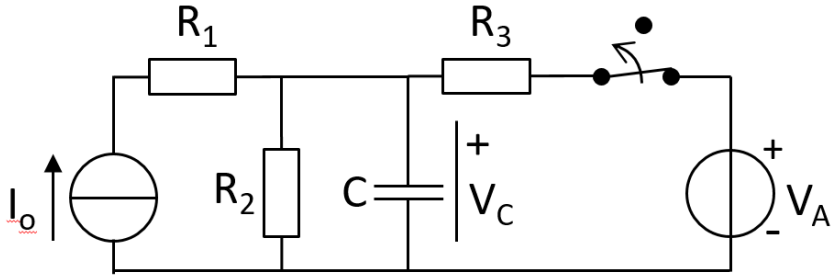
Problem 5



The switch has been closed for a long time. At t=0 s the switch opens. V_A=5 V, R_1=1 kΩ, R_2=4 kΩ and C=2.5 nF.

A) What is the enegry stored in the capacitor at t=0 s?
B) What is the energy stored in the capacitor at t=10 μs?

Problem 6



The switch has been closed for a long time. At time t=1 μs the switch opens. R_1=10 kΩ, R_2=R_3=1 kΩ, C=2 nF, I_0=2 mA and V_A=6 V.
Plot $V_C(t)$ in the intervall 0<t<7 μs.