Home Assignment 4, IE1206 & IF1330, VT2020

Problem 1

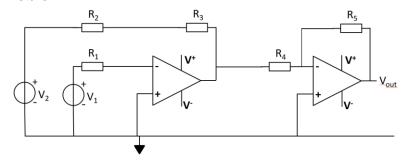
Per-Erik connected a load resistor R_L to a battery rated to be 9V. He measured the voltage (V_L) over the load resistor for different values of R_L . The measured data is shown in the table below.



$R_{\rm L}$	100 kΩ	10 kΩ	1 kΩ	177 Ω	38Ω
VL	9.16	9.15	9.01	8.58	7.28

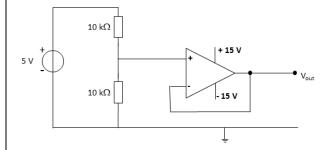
Determine the Thevenin equivalent of the 9V battery.

Problem 2



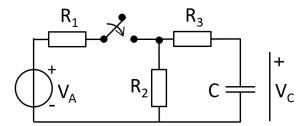
- A) Determine the output voltage V_{out} as as function of V_1,V_2 , R_1 , R_2 , R_3 , R_4 and R_5 . Assume the operational amplifiers are ideal and operates in the linear region.
- B) Determine V_{out} if $V_1=2$ V, $V_2=3$ V and $R_1=R_2=R_3=R_4=R_5=2$ k Ω .

Problem 3



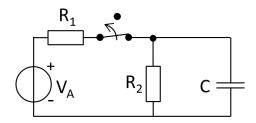
- (A) Determine the output voltage V_{out} assuming that the op-amp operates in the linear region and is ideal.
- (B) What is the function of the op-amp (think about the op-amp input resistance)? What function does the circuit perform?

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 k Ω , R_3 =5 k Ω and C=100 nF.

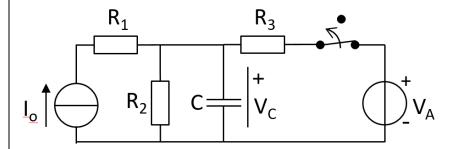
Problem 5



The switch has been closed for a long time. At t=0 s the switch opens. $V_{A=5}$ V, $R_{1}=1$ k Ω , $R_{2}=4$ k Ω 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 $t=10 \mu s$?

Problem 6



The switch has been closed for a long time. At time t=1 μ s the switch opens. R₁=10 k Ω , R₂=R₃=1 k Ω , C=2 nF, I₀=2 mA and V_A=6 V. Plot V_C(t) in the intervall 0<t<7 μ s.