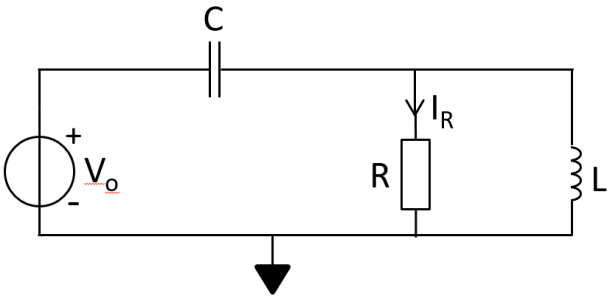
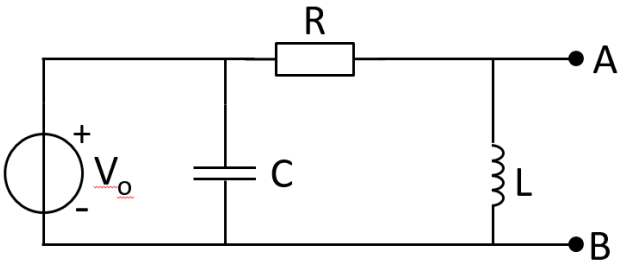
Home Assignment 6, IE1206 & IF1330, VT2020

Problem 1



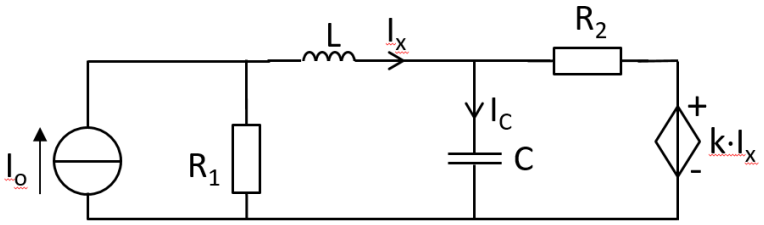
The circuit has a sinusoidal voltage source $V_o=5\cos(\omega t)$ V. Determine $I_R(t)$ when $\omega=10^5$ rad/s, C=20 nF, R=1 kΩ and L=10 mH.

Problem 2



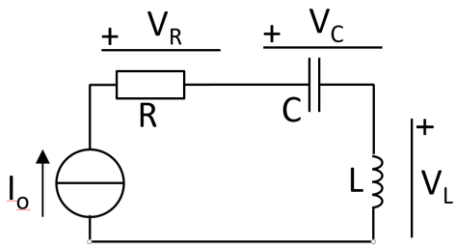
The circuit has a sinusoidal voltage source $V_o=5\cos(\omega t+30°)$ V. Determine the Thévenin equivalent circuit at nodes A-B. The angular frequency $\omega=10^6$ rad/s, C=10 nF, R=100 Ω and L=100 μH.
Also draw a schematic diagram in time domain with component values of the Thévenin circuit.

Problem 3



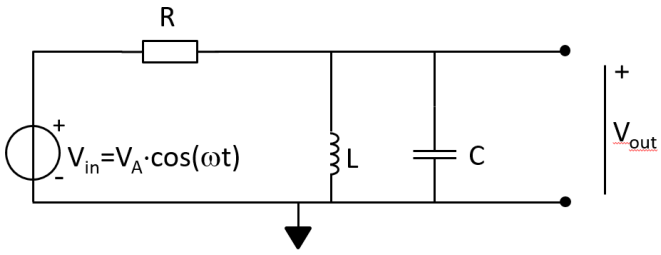
The current source is a sinusoidal source with $I_o=3\cos(\omega t)$ mA. Determine the current I_C when R_1=2 kΩ, R_2=6 kΩ, C=25 nF, L=200 mH and k=2 V/mA.

Problem 4



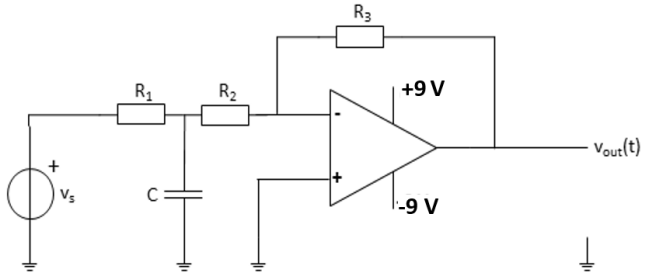
The current source I_o=2cos(ωt) mA. Determine V_R(t), V_C(t) and V_L(t).
ω=10^5 rad/s, R=1 kΩ, L=20 mH and C=10 nF.

Problem 5



V_{in} is a sinusoidal voltage source. The R,L,C circuit performs a filter function.
(A) Express V_{out} as a function of V_{in}, ω, R, L and C in the frequency (complex) domain.
(B) Analyse the expression derived in A and motivate what filter function the circuit performs.
(C) At a specific ω the output voltage V_{out} has a maximum amplitude. What is the phase angle of V_{out} at that frequency?

Problem 6



Vs=20cos(5000t) [V], R1=50 Ω, R2=50 Ω, R3=65 Ω, C=8 μF. Assume the op-amp is ideal.

(A) Assume that the op-amp operates in the linear region. Determine V_{out}(t).
(B) Motivate if the op-amp operates in the linear region or not in (A).