The Ohio State University
Department of Electrical Engineering

ECE 205

Circuit Analysis

Home work Set # 7

Print Your Name

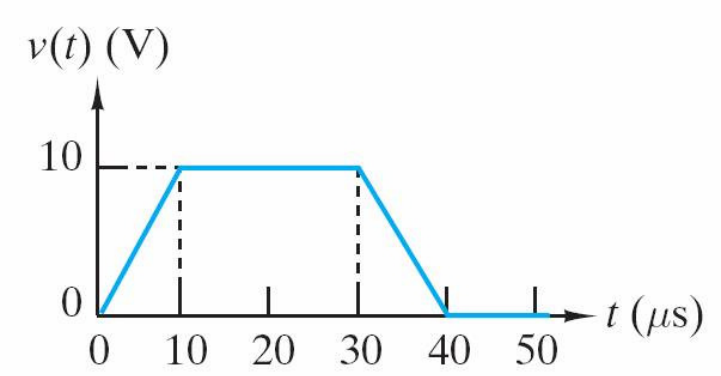
_____

Problem#1: Problem 6-2 textbook

The voltage across a 3mF capacitor is $v_C(t) = 20\sin(2\pi 10t)\,\text{V}$. Derive expressions for $i_C(t)$ and $p_C(t)$. Is the capacitor absorbing or delivering power?

Problem#2: Problem 6-6 textbook

The voltage across a 0.5 μF capacitor is shown in the Figure. Sketch $i_C(t)$ and $p_C(t)$. Is the capacitor absorbing or delivering power?

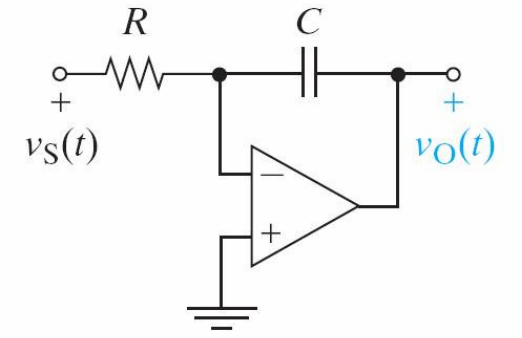


Problem#3: MATLAB Problem

A voltage of $v_L(t) = 5\cos(1000t) - 2\sin(3000t)V$ appears across a 50mH inductor. Derive an expression for $i_L(t)$ assuming $i_L(0)=0$. Discuss the effect of frequency on the relative amplitudes of the sinusoidal components of $i_L(t)$ and $v_L(t)$. Sketch theses waveforms in MATLAB.

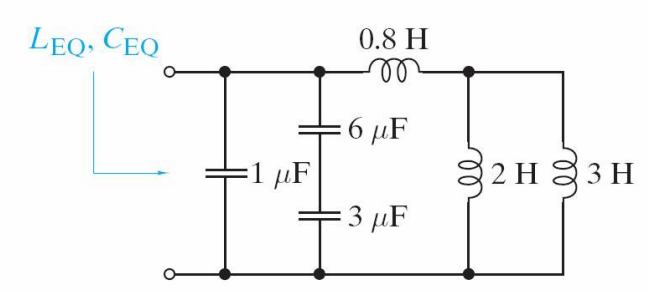
Problem#4: Problem 6-21 textbook

The OP AMP integrator in the Figure has R=40 kΩ, C=50 nF, and $v_O(0)$=10 V. The input is $v_S(t) = 10e^{-500t}u(t)\ V$. Find $v_O(t)$ for t>0.



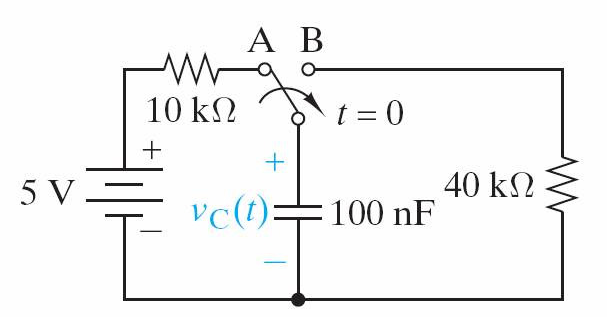
Problem#5: Problem 6-40 textbook

For the circuit given find an equivalent circuit consisting of one inductor and one capacitor.



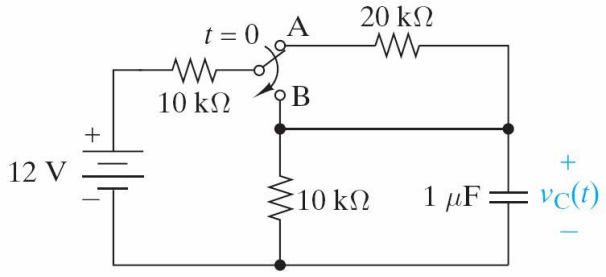
Problem#6: Problem 7-7 textbook

The switch has been in position A for a long time and is moved to position B at t=0. Find $v_c(t)$ for $t \geq 0$.



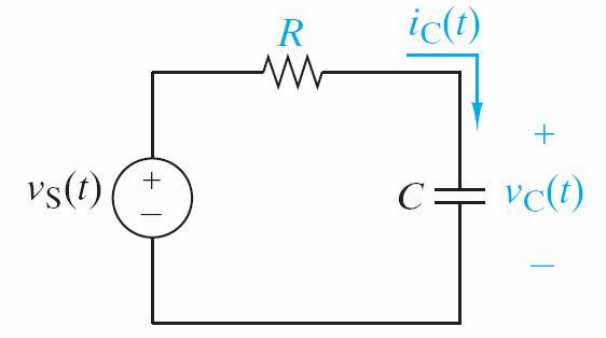
Problem#7: Problem 7-13 textbook

The switch has been in position A for a long time and is moved to position B at t=0. Find $v_C(t)$ for $t \geq 0$. Identify te forced and natural components in the response.



Problem#8: Problem 7-26 textbook

For t≥0 the step response of the current through the capacitor in Figure is $i_C(t) = 20e^{-2000t}\,mA$. Find $v_C(t)$ for t≥0 when C=1μF and $v_C(0)$=5 V.



Problem#9: Problem 7-27 textbook

For t≥0 the step response of the current through and voltage across the inductor are:

$i_L(t) = 5 - 10e^{-2000t}\,mA$ and $v_L(t) = e^{-2000t}V$

(a) Find v_s, R and L.
(b) Find the energy stored in the inductor at t=ln(2)/2 ms.