Cairo University
Faculty of Engineering
Electronics and Electrical
Communication Department.

AC Circuits 1
1st year
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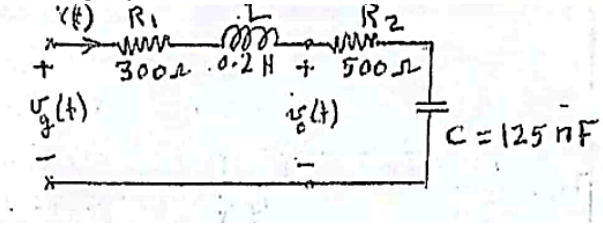
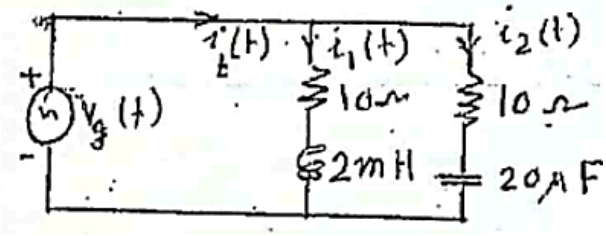
SHEET 7
AC TIME DOMAIN ANALYSIS

Problem [1]:
In the circuit shown below, $v_g(t) = 100\cos(8000t)\,V$. Find $i(t)$ and $v_o(t)$. Sketch $v_g(t), i(t), and\ v_o(t)$ on the same graph. Calculate the P.F. and the average power.



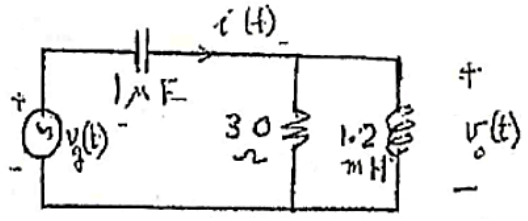
Answers: $i(t) = 0.1\cos(8000t - 36.87^o)\,A$, $v_o(t) = 50\cos(8000t - 100.30^o)\,V$,
$P.F. = 0.8\ Lagging$, $P_{avg} = 4W$.

Problem [2]:
In the circuit shown below, if $v_g(t) = 100\sin(5000t)\,V$. Find $i_1(t), i_2(t) and\ i_t(t)$ and sketch their waveforms on the same graph. Calculate the average power.



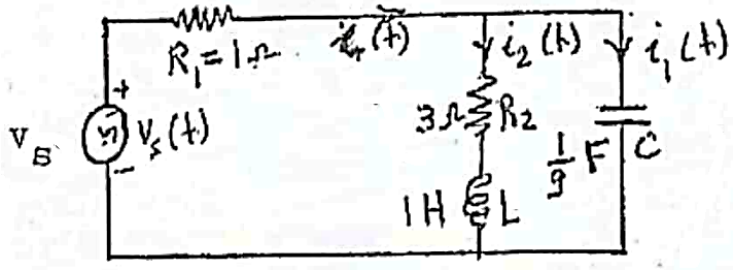
Answers: $i_1(t) = 5\sqrt{2}\sin(5000t - 45^o)\,A$, $i_2(t) = 5\sqrt{2}\sin(5000t + 45^o)\,A$
$i_t(t) = 10\sin(5000t)\,A$, $P_{avg} = 500W$

Problem [3]:
In the circuit shown below, if $i_t(t) = 0.5\sqrt{10}\cos(50000t + 18.43^o)\,A$. Find $v_o(t), v_g(t)$ and calculate the P.F. and P_{avg}.



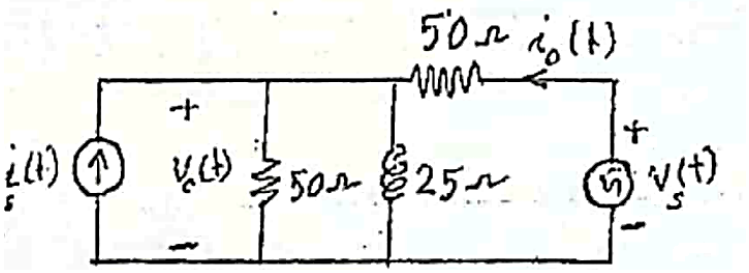
Answers: $v_o(t) = 30\sqrt{2}\cos(50000t + 45^o)\,V$, $v_g(t) = 40\cos(50000t)\,V$
$P.F. = 0.9487\ Leading$, $P_{avg} = 30W$

Problem [4]:
In the circuit shown below, $i_1(t) = 2\sqrt{2}\cos(3t + 81.9^o)\,A$. Find $i_2(t),\ i(t), and\ v_s(t)$. Calculate the average power consumption and sketch the waveforms on the same graph.



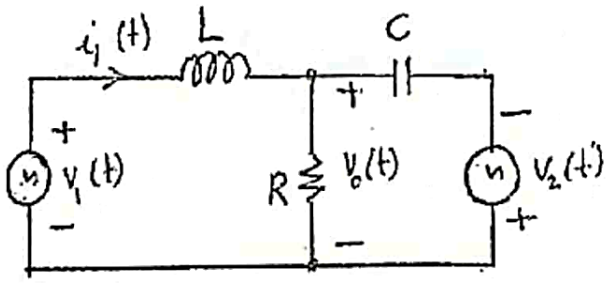
<u>Answers</u>: $i_2(t) = 2\cos(3t - 53.1^o)\,A$, $\quad i(t) = 2\cos(3t + 36.87^o)\,A$
$v_s(t) = 10\cos(3t)\,V$, $\quad P_{avg} = 8W$

Problem [5]:
In the circuit shown below, if $i_s(t) = 2\sqrt{2}\sin(\omega t + 45^o)\,A$ and $v_s(t) = 100\sin(\omega t)$, find $v_o(t)\ and\ i_o(t)$. Calculate the average power consumption in R1 and R2.



<u>Answers</u>: $v_o(t) = 25\sqrt{10}\sin(\omega t + 71.565^o)\,V$, $\quad i_o(t) = 1.5\sqrt{2}\sin(\omega t - 45^o)\,A$
$P_{avg}(in\ R1) = 62.5W$, $\quad P_{avg}(in\ R2) = 112.5W$

Problem [6]:
In the circuit shown below, $v_1(t) = 20\cos(\omega t - 31.87^o)\,V$, $v_2(t) = 50\cos(\omega t + 73.74^o)\,V$, $\omega = 2000\ rad/s$, $R = 10\Omega, L = 1mH$ and $C = 100\mu F$. Use source transformations to find $v_o(t)\ and\ i_1(t)$. Calculate the average power consumption in R.



<u>Answers</u>: $v_o(t) = 36\cos(\omega t)\,V$, $\quad i_1(t) = 11.66\sin(\omega t - 120.96^o)\,A$
$P_{avg} = 64.8W$

Homework:

In the circuit shown below, $i_g(t) = 3\cos(200t)\,A$, $L = 2mH$ and $C = 12.5mF$. Find $v_o(t)$ and $i_1(t)$. Calculate the average power supplied by $i_g(t)$ and that in dissipated in the circuit. Check the power balance.