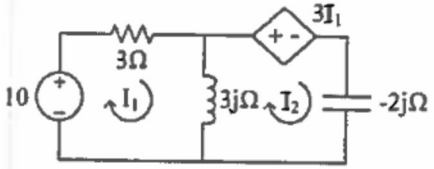
Sp 2013

Problem 2

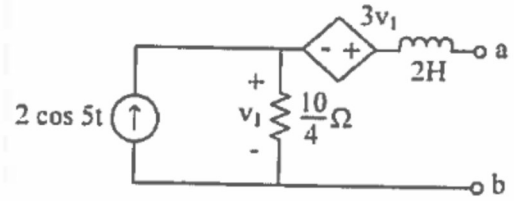
(a) In the following circuit, write two loop equations in terms of I_1 and I_2.



( )I_1 +( )I_2 =( )

( )I_1 +( )I_2 =( )

(b) For the following circuit, find I_N, Z_T and maximum available average power of the circuit between a and b. (Give I_N and Z_T in rectangular form i.e. $\alpha + j\beta$)



I_N = _____

Z_T = _____

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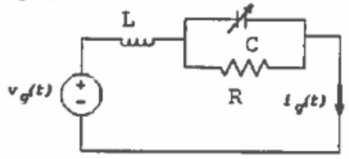
2. (25 pts) The circuit shown below is operating in the sinusoidal steady state. The capacitance C is variable and is adjusted until the current $i_g(t)$ is in phase with the sinusoidal voltage $v_g(t)$.

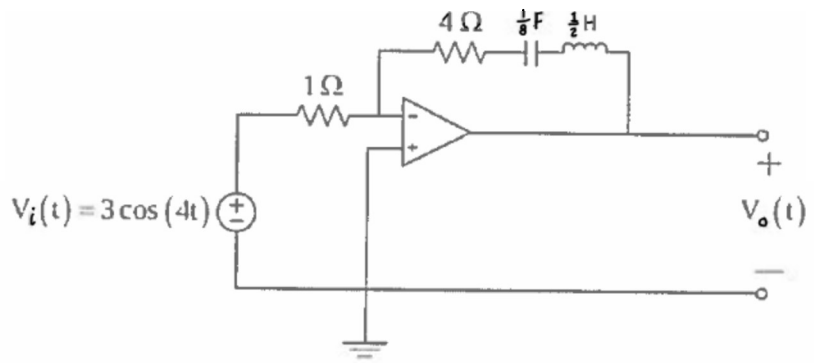


(a) What is the value of capacitance C when $L = 1\text{H}$, $R = 2\Omega$ and $v_g(t) = 4\cos(t)\text{V}$?

$C =$ _____

(b) For the value of C identified in part (a), give the expression for $i_g(t)$, expressed in A.

Problem 2



Assume the op-amp in this circuit is an ideal op-amp.

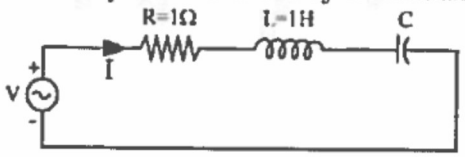
a) (15 points) Use the phasor method to calculate the output voltage $V_o(t)$.

b) (5 points) If a $1000\,\Omega$ resistor is connected across the output terminals, what is the average power dissipated by the resistor?

Problem 2 (continued)

c) (5 points) The op-amp is biased at $\pm 15V$. How would the output voltage change as the input signal frequency is increased or decreased from 4 rad/s? Explain your reasoning.

2. (25 pts) An RLC series circuit consisting of a 1Ω resistor R, an inductance of value $L = 1$ H and a capacitor C is fed by a cosinusoidal voltage source.



(a) If the cosinusoidal voltage source has angular frequency $\omega = 1$ rad/s and the current leads (is ahead of) the voltage at the source by 45°, what is the value of the capacitor C?

$C =$ _____