NAME_____

Instructor/College_____

Section_____

Score_____

EE 153 FINAL EXAM

WINTER SEMESTER 2000

CLOSED BOOK

2 HOUR TIME LIMIT

CALCULATORS ARE ALLOWED

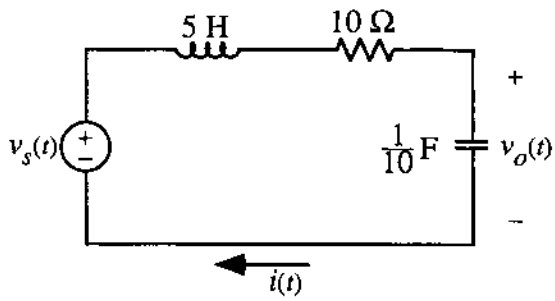
There are 12 problems; please look over your exam to make sure you have 12 different problems. **Do any ten (10) problems!** Draw a large X through the two problems that you do not want to be graded. If you do not indicate which problems you want to leave out, the first 10 problems will be graded.

Do all work for each problem only on the page(s) supplied for that problem. **DO NOT**, for instance, continue Problem 3 on the back of Problem 2. Extra blank paper will be supplied if needed. If extra paper is used, show the additional work for each problem on a separate sheet and staple the extra sheet(s) to the appropriate problem(s).

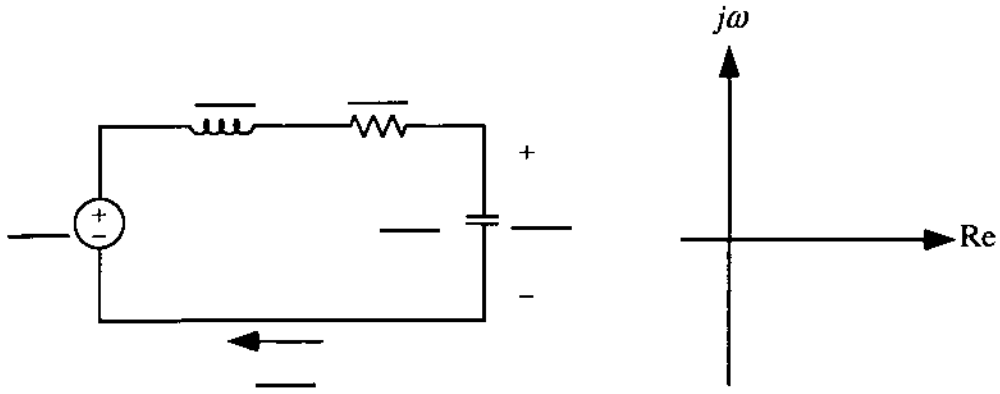
ALL PHASORS WILL BE IN BOLD FACE TYPE

(1) Consider the following circuit driven by voltage source $v_s(t) = 100\cos(2t + 30°)$ V.

Redraw the circuit in frequency domain.
Calculate voltage $v_o(t)$ and current $i(t)$.
Show the voltage phasors $\mathbf{V}_s$ and $\mathbf{V}_o$, and $\mathbf{I}$ on phasor diagram.
Write differential equation relating v_o and v_s.
Find transfer function $H(j\omega) = \mathbf{V}_o / \mathbf{V}_s$.



Answer:



$v_o(t) =$_____ $i(t) =$_____ $v_s(t) =$_____

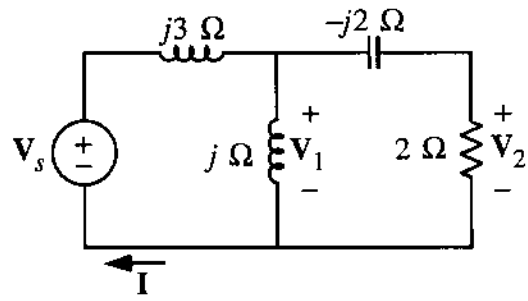
(_____)v_o = (_____)v_s

$H(j\omega) =$_____

Problem Score

(2) For the following circuit

Find $\mathbf{H}_{1s}(j\omega) = \mathbf{V}_1 / \mathbf{V}_s$
Find $\mathbf{H}_{21}(j\omega) = \mathbf{V}_2 / \mathbf{V}_1$
Find $\mathbf{H}_{2s}(j\omega) = \mathbf{V}_2 / \mathbf{V}_s$
Given that $v_s(t) = 100\cos(10t + 45°)$ V,
find $v_2(t)$.



Answer:

$\mathbf{H}_{1s}(j\omega) =$ _____

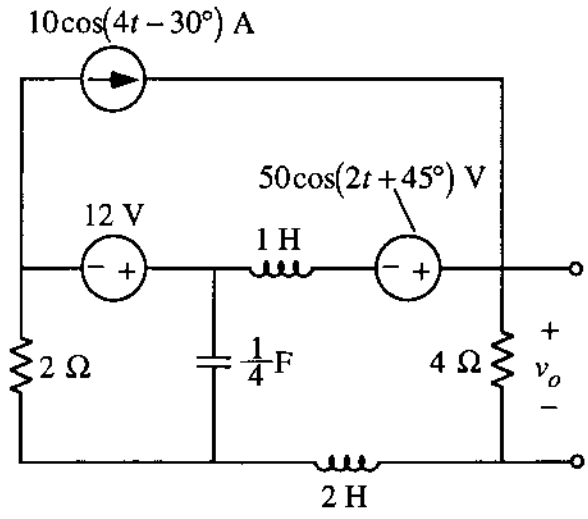
$\mathbf{H}_{21}(j\omega) =$ _____

$\mathbf{H}_{2s}(j\omega) =$ _____

$v_2(t) =$ _____

Problem Score

(3) Find $v_o(t)$ for the following circuit.



Answer:

$v_o(t) =$ _____

Problem Score

(4) A 240 V_{rms} single phase 60 Hz system is connected to a 20 hp motor that is 95% efficient and a power factor of .8 lagging. Draw power triangle. Find line current I_{L1}. A second load of either an inductor or a capacitor is added in parallel to make the power factor equal to 1. Find the size of the added capacitor or inductor and the line current, I_L of the combined load. (745.7 watt = 1 hp)

Answer:

Power Triangle

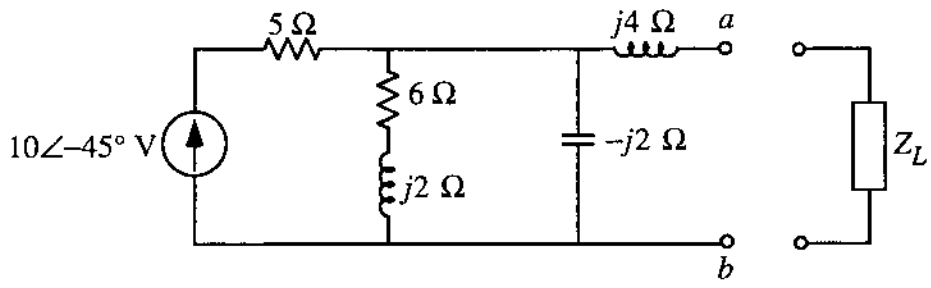
I_{L1}_____

C or L =_____

I_L =_____

Problem Score

(5) For the following circuit: Find the Thévenin equivalent current. What load Z_L should be added across terminals *a*-*b* so that maximum power is delivered to the load. What is the maximum transfer power $p_{L(\max)}$ to the above load.



Answer:

Z_{TH} =_____

V_{TH} =_____

Z_L =_____

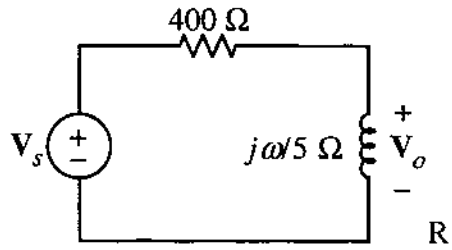
$p_{L(\max)}$ =_____

Problem Score

(6)

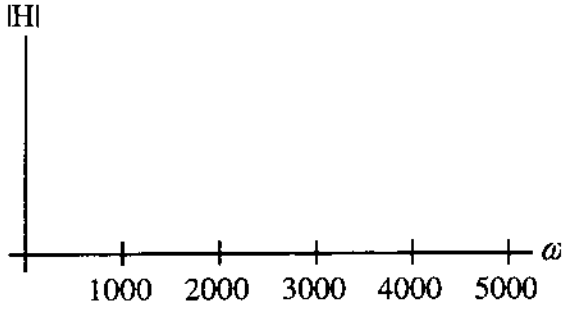
Find transfer function $\mathbf{H}(j\omega)=\frac{\mathbf{V}_o}{\mathbf{V}_s}$. Graph $|H|$ vs ω.

Find half power cutoff frequency. Determine if it is a high pass, low pass, band pass or band reject filter. Find $v_o(t)$ if $v_s(t)=100\cos(1000t+30°)$.



Answer:

$H(j\omega)=$_____



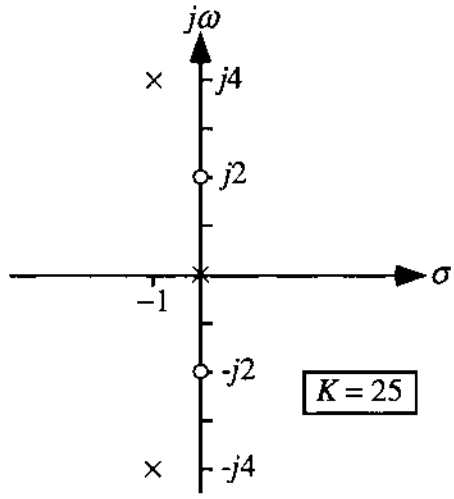
$\omega_c=$_____

high pass low pass band pass band reject

$v_o(t)=$_____

Problem Score

(7) The pole-zero plot shown below refers to an impedance, **Z**(s). Find **Z**(s), and the particular response, $v_p(t)$ for an input $i(t) = 6\cos(t + 45°)$ A



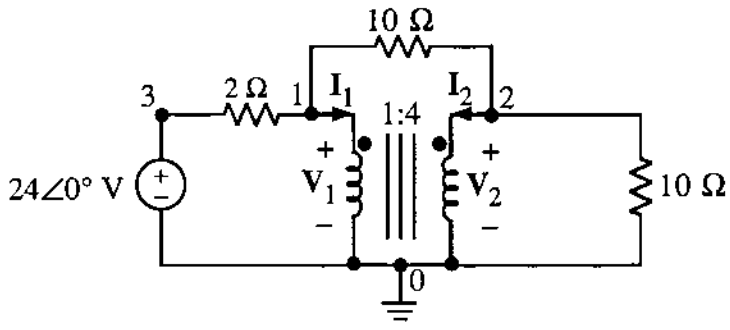
Answer:

$\mathbf{Z}(s) =$ _____

$v_p(t) =$ _____

Problem Score

(8) Determine the node voltages, $\mathbf{V}_1$ and $\mathbf{V}_2$ in the following network.



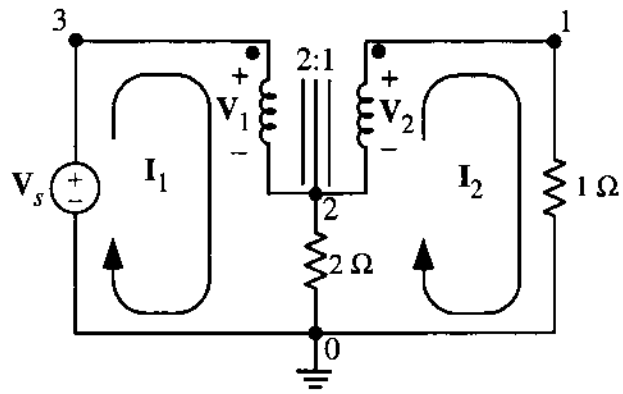
Answer:

$\mathbf{V}_1$ = _____

$\mathbf{V}_2$ = _____

Problem Score

(9) Determine the mesh currents, $\mathbf{I}_1$ and $\mathbf{I}_2$ in the following circuit if $\mathbf{V}_s = 120\angle 0°$ V.



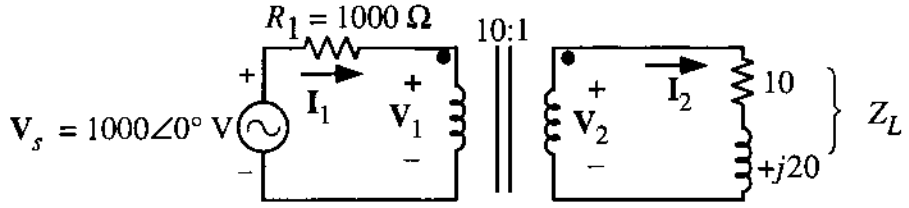
Answer:

$\mathbf{I}_1 =$ _____

$\mathbf{I}_2 =$ _____

Problem Score

(10) For an ideal transformer shown below find the power, P_L delivered to the load.



Answer:

P_L = _____

Problem Score

(11) Each phase of a (wye)Y-connected load consists of a 50 Ω resistance in parallel with a 100 μF capacitance. Find the impedance of each phase, $\mathbf{Z}_{\Delta}$ of an equivalent (delta)Δ-connected load. The frequency of operation is 60 Hz.

Answer:

$\mathbf{Z}_{\Delta}$ =_____

Problem Score

(12) A balanced three-phase source serves three loads as follows:

Load 1: 24 kW at 0.6 lagging power factor,

Load 2: 10 kW at unity power factor

Load 3: 12 kVA at 0.8 leading power factor

If the line voltage at the loads is 208 V_{rms} at 60 Hz, determine the line current, I_L and the combined power factor of the loads, PF_{load}.

Answer:

I_L = _____

PF_{load} = _____

Problem Score