EES216: Circuit Analysis
Final Mock Exam

curated by The Peanuts

Name . . . . . ID . . . . . Section . . . . . No . . . . . .

Conditions: Semi-Closed Book (A3 Both Sides)

Directions:

1. This exam has 10 pages (including this page).
2. Calculators (Casio 991 Series) are allowed.
3. Write your name clearly at the top of each page.
4. Please check to make sure that there are 6 problems in your exam paper. (It's a PDF, I know)
5. Red color is reserved for grading. Do not write in red.
6. Do not cheat. Do not panic.
7. Good Luck + Warm Wish for a bright and joyful coming new year.

For solution, click here.

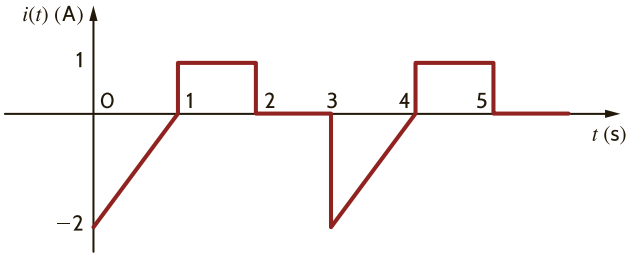
Problem 1

The voltage $v(t)$ in a network is defined by the equation.

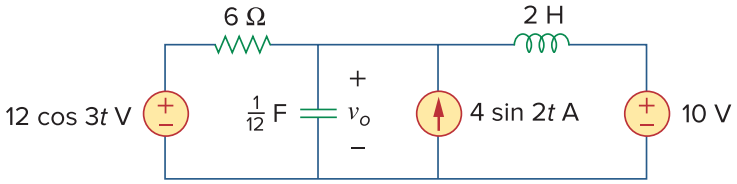
$$\frac{d^2v_1(t)}{dt^2} + 8\frac{dv_1(t)}{dt} + 10v_1(t) = 0.$$

Identify the type of this second-order system: _____

Calculate the rms value of the waveform



Solve for $v_o(t)$ in the circuit using the superposition principle.



a) Find v_{o_1} due to 10 V voltage source. $v_{o_1} =$ _____

b) Find v_{o_2} due to $12\cos 3t$ V source. $v_{o_2} =$ _____

c) Find v_{o_3} due to $4\sin 2t$ A source. $v_{o_3} =$ _____

d) Find $v_o =$ _____

In Thailand, the electricity system operates at what standard voltage and frequency?

Voltage = _____ volts, Frequency = _____ Hz

State **three** benefits of a three-phase electrical system

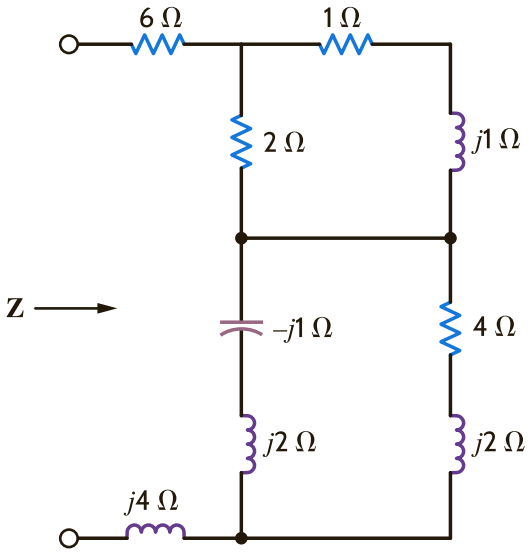
1. _____

2. _____

3. _____

Problem 2

Find the equivalent impedance, **Z**, for the circuit.

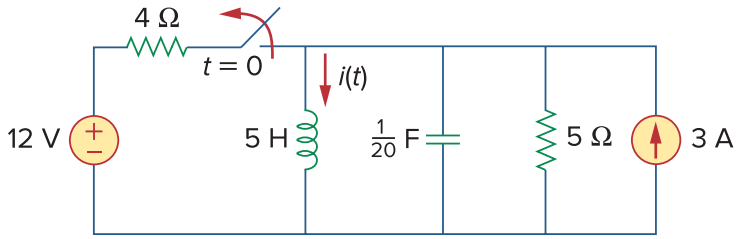


Find $v(t)$ in the following integrodifferential equations using the phasor approach:

$$\frac{dv}{dt} + 5v(t) + 4\int vdt = 20\sin(4t + 10^\circ)$$

Problem 3

For the following circuit, the switch opens at $t = 0$:



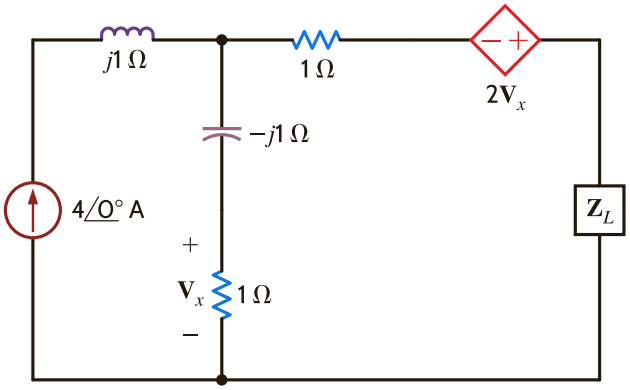
a) Find $I_L(0) =$ _____ and $V_c(0) =$ _____

b) Find $\frac{dI_L(0)}{dt} =$ _____ and $\frac{dV_c(0)}{dt} =$ _____

c) Find $I_L(\infty) =$ _____ and $V_c(\infty) =$ _____

d) Find $I_{L_n}(t) =$ _____ in term of two unknown constants.

Problem 4



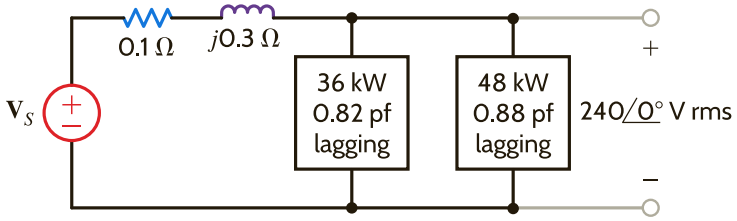
Find the load impedance $\mathbf{Z}_L =$ _____ for maximum average power transfer

Formula for finding the maximum average power is _____

The value of the maximum average power transferred to $\mathbf{Z}_L$ is = _____

Problem 5

A source supplies power through a line with impedance $0.1 + j0.3\ \Omega$ to two parallel loads. The first load absorbs 36 kW at 0.82 power factor lagging, and the second load absorbs 48 kW at 0.88 power factor lagging. The load voltage is $240\angle 0°$ V rms.



Find the total complex power at the load $\mathbf{S}_L$, the total current $\mathbf{I}_L$, and the equivalent load impedance $\mathbf{Z}_L$.

Determine the complex power at the source $\mathbf{S}_S$.

Indicate the source voltage $\mathbf{V}_S$ and the generator power factor.

Problem 6

A balanced three-phase delta-connected source supplies power to a load consisting of a balanced delta in parallel with a balanced wye. The phase impedance of the delta is $27 + j16\ \Omega$, and the phase impedance of the wye is $12 + j8\ \Omega$. The *abc*-phase-sequence source voltage is $\mathbf{V}_{ab} = 330\angle 60^\circ\ V_{\text{rms}}$, and the line impedance per phase is $1 + j0.08\ \Omega$. **Find the line currents and the power absorbed by the wye-connected load.**