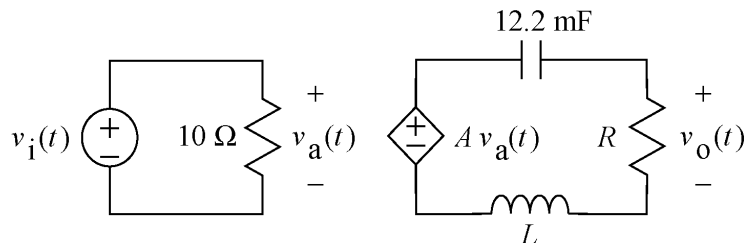


Additional Practice Problems for EE221 Final Exam

1. The input to the circuit is the voltage of the voltage source, $v_i(t)$. The output is the voltage $v_o(t)$. The step response is $v_o(t) = 6e^{-4t} \sin(5t)u(t)$.

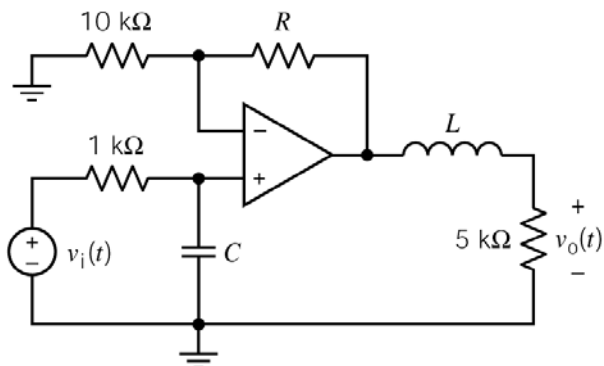


Determine the values of the gain, A , of the VCVS, the resistance, R , and the inductance, L .

$$A = \text{_____ V/V}, R = \text{_____ } \Omega \text{ and } L = \text{_____ H}.$$

2. The input to this circuit is the voltage source voltage, $v_i(t)$. The output is the voltage, $v_o(t)$. The transfer function of this circuit is

$$H(s) = \frac{V_o(s)}{V_i(s)} = \frac{15 \times 10^6}{(s + 2000)(s + 5000)}$$



Determine the values of R , L and C :

$$R = \text{_____ k}\Omega, L = \text{_____ H} \text{ and } C = \text{_____ } \mu\text{F}.$$

or

$$R = \text{_____ k}\Omega, L = \text{_____ H} \text{ and } C = \text{_____ } \mu\text{F}.$$

3. The transfer function of a circuit is $H(s) = \frac{12}{s^2 + 8s + 16}$. The step response of this circuit is: $\text{step response} = [b - e^{-at}(c + dt)]u(t)$. Determine the values of the constant coefficients a , b , c and d :

$$a = \text{_____ } 1/s, \quad b = \text{_____ V}, \quad c = \text{_____ V} \quad \text{and} \quad d = \text{_____ V}.$$

4. The transfer function of a circuit is $H(s) = \frac{80s}{s^2 + 8s + 25}$. The step response of this circuit is: $\text{step response} = [be^{-at} \sin(ct)]u(t)$. Determine the values of the constant coefficients a , b , c and d :

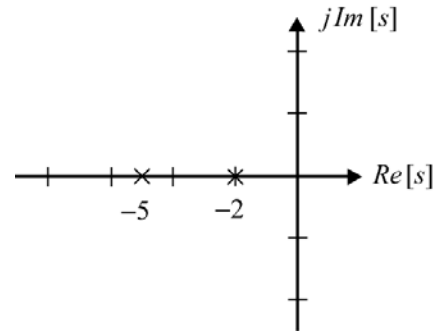
$$a = \text{_____ } 1/s, \quad b = \text{_____ V}, \quad \text{and} \quad c = \text{_____ V}.$$

5. The input to a linear circuit is the voltage, v_i . The output is the voltage, v_o . The transfer function of the circuit is

$$H(s) = \frac{V_o(s)}{V_i(s)}$$

The poles and zeros of $H(s)$ are shown on this pole-zero diagram. (There are no zeros.) The dc gain of the circuit is

$$\mathbf{H}(0) = 5$$

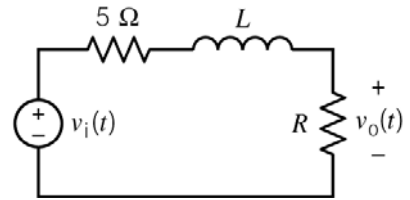


The step response of the circuit is $v_o(t) = (a + b e^{-5t} - c e^{-2t})u(t)$ V. Determine the values of the constants a , b and c .

$$a = \text{_____ V}, \quad b = \text{_____ V} \quad \text{and} \quad c = \text{_____ V}.$$

6. The input to a circuit is the voltage source voltage, v_i . The step response of the circuit is

$$v_o(t) = \frac{3}{4}(1 - e^{-100t})u(t) \text{ V}$$



Determine the value of the inductance, L , and of the resistance, R

$$R = \text{_____ } \Omega \quad \text{and} \quad L = \text{_____ H}.$$

7. The input to a circuit is the voltage source voltage, v_i . The step response of the circuit is

$$v_o(t) = 5(1 - (1 + 2t)e^{-2t})u(t) \text{ V}$$

When the input is $v_i(t) = 5 \cos(2t + 45^\circ)$ V

the steady-state response is $v_i(t) = A \cos(2t + \theta)$ V

Determine the values of A and θ .

$$A = \text{_____ V} \quad \text{and} \quad \theta = \text{_____ } ^\circ.$$

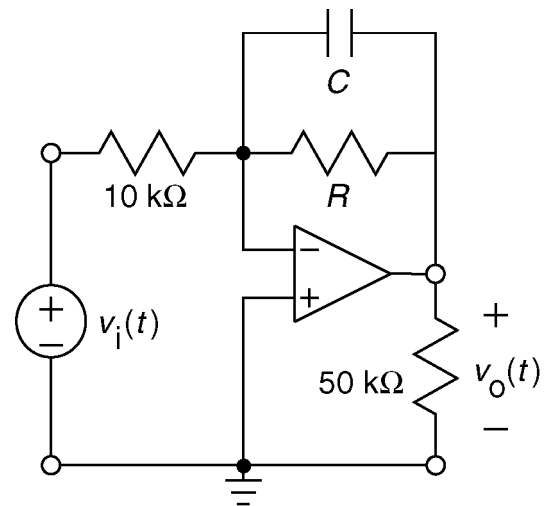
8. The input to a circuit is the voltage $v_i(t)$. The output is the voltage $v_o(t)$.

When the input is:

$$v_i(t) = 2 + 4\cos(100t) + 5\cos(200t + 45^\circ) \text{ V}$$

the corresponding output is:

$$v_o(t) = -5 + 7.071\cos(100t + 135^\circ) + c_2\cos(200t + \theta_2) \text{ V}$$



Determine the value of R , C , c_2 , and θ_2 :

$$R = \text{_____ k}\Omega, \quad C = \text{_____ }\mu\text{F}, \quad c_2 = \text{_____ V} \quad \text{and} \quad \theta_2 = \text{_____ }^\circ$$

9. The transfer function of a circuit is $H(s) = \frac{20}{s+8}$. When the input to this circuit is sinusoidal,

the output is also sinusoidal. Let ω_1 be the frequency at which the output sinusoid is twice as large as the input sinusoid and let ω_2 be the frequency at which output sinusoid is delayed by one tenth period with respect to the input sinusoid. Determine the values of ω_1 and ω_2 .

$$\omega_1 = \text{_____ rad/s} \quad \text{and} \quad \omega_2 = \text{_____ rad/s}$$