EE2210 Electric Circuits Fall 2023

Quiz 3 (Total 100 points)

It is a closed-book, closed-note quiz. Cheating leads to 0% score.

Calculator is allowed. Please show the process of thinking/calculation. Indicate your final answers clearly. Unit is needed if applicable.

1. Show the relationship of the output voltage, v_O, to the input voltage, v_i, of the circuit in Figure 1. (15%)

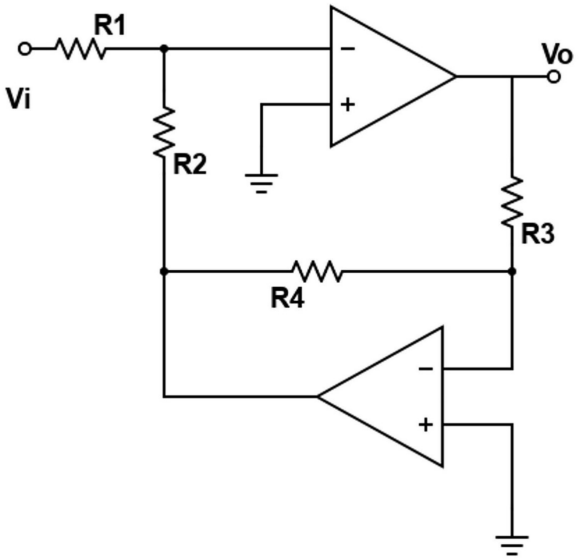


Figure 1.

2. An ideal voltmeter (v_m) is used to measure the output voltage of the circuit in Figure 2. What is the reading of the voltmeter? (15%)

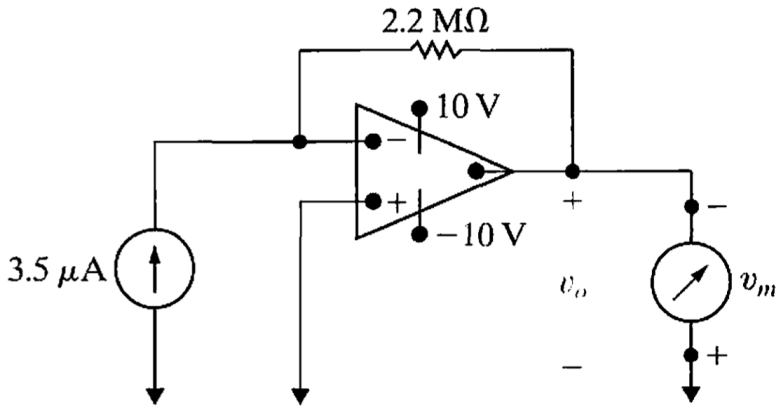


Figure 2.

3. Find v_O in Figure 3. (15%)

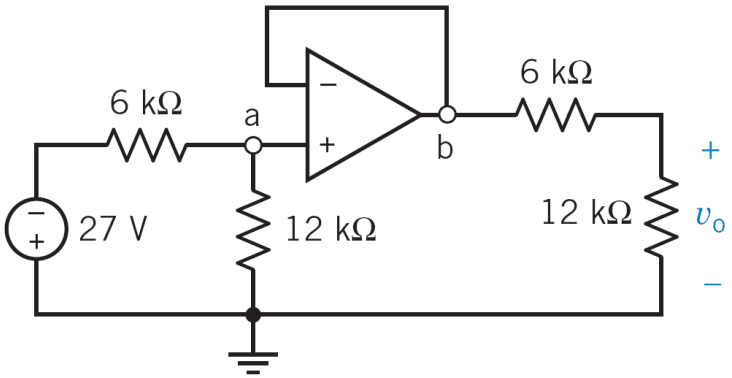


Figure 3.

4. Design the operational amplifier in Figure 4 such that $i_{out} = 0.002 * v_{in}$. (15%)

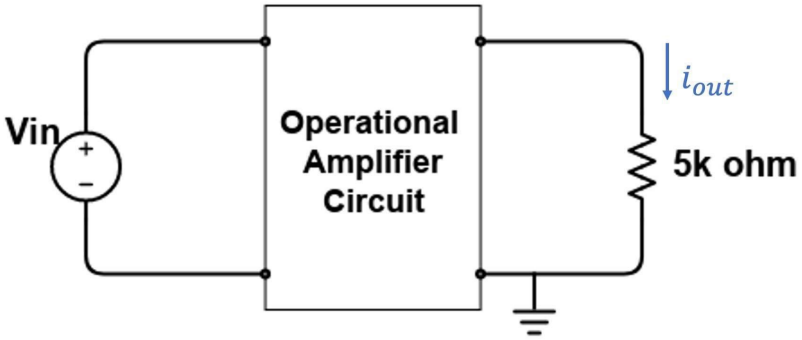


Figure 4.

5. Consider the circuit in the following figure. The input v_i = 10t V when t > 0 and v_i = 0 V when t ≤ 0. Derive and plot the current of the inductor, *i* for t ≥ 0. (20%)

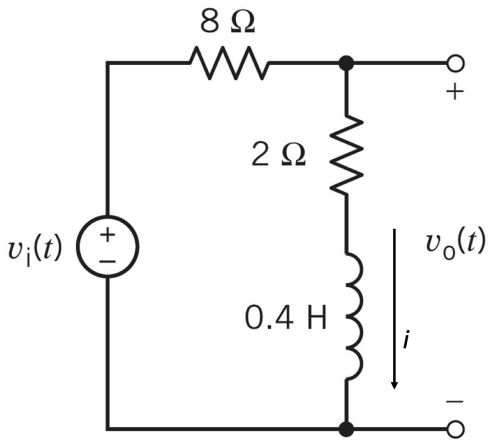


Figure 5.

6. Consider the circuit in Figure 6 with the voltage source v_i = 20*u(t-5) where u(t) represents a unit step function. Derive and plot v_o for t ≥ 0. (20%)

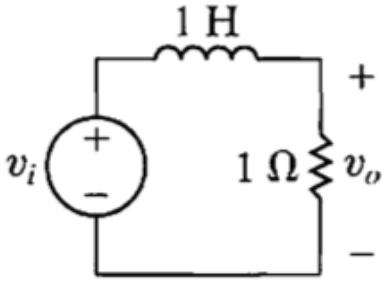
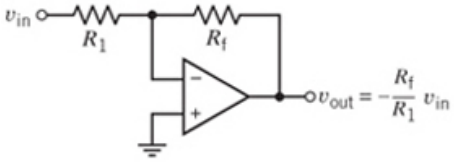
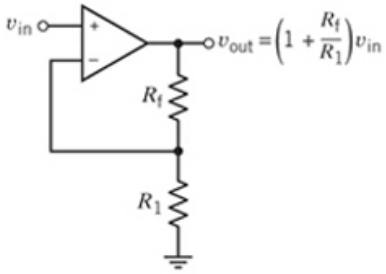


Figure 6.

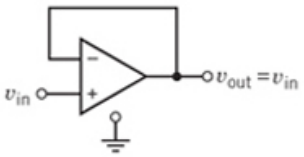
Reference materials



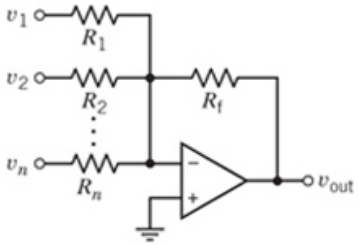
(a) Inverting amplifier



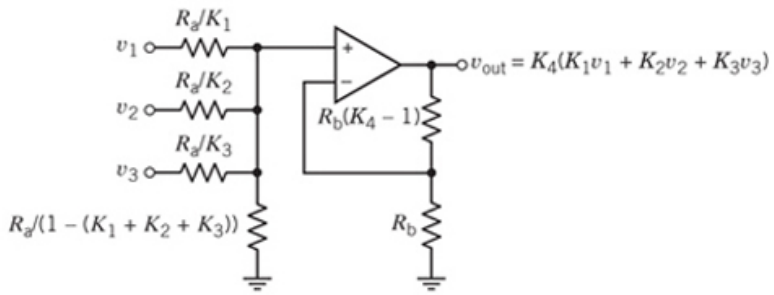
(b) Noninverting amplifier



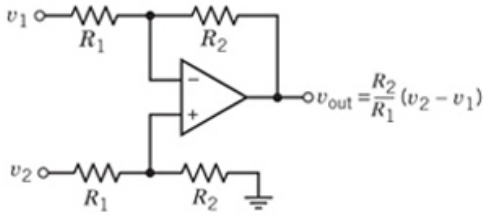
(c) Voltage follower (buffer amplifier)



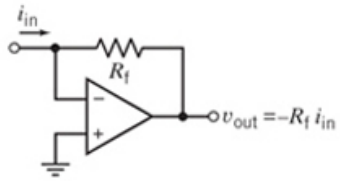
(d) Summing amplifier



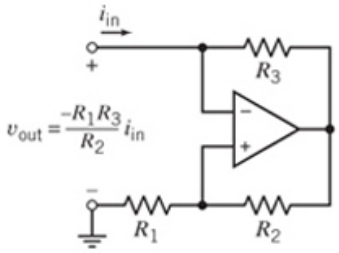
(e) Noninverting summing amplifier



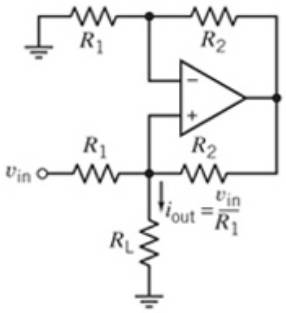
(f) Difference amplifier



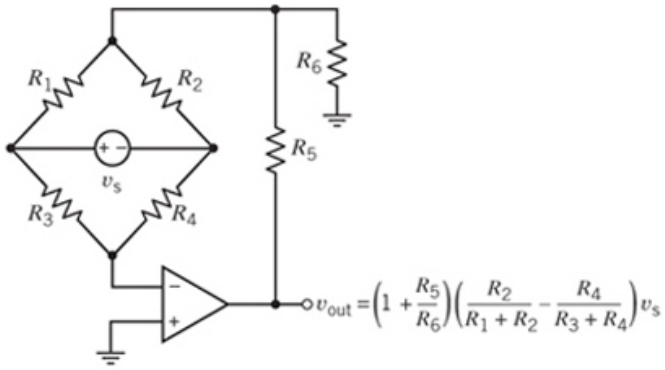
(g) Current-to-voltage converter



(h) Negative resistance convertor



(i) Voltage-controlled current source (VCCS)



(j) Bridge amplifier