ECE 214 — Exam #1

Estimated time for completion: $\leq$ 1.25 hour
5 March 2020

Rules of the Exam

Rule 1: The examination period begins at 9:30 am on Thursday, 5 March 2020, and ends at 10:45 am on Thursday, 5 March 2020.

Rule 2: The exam is worth 20% of your grade.

Rule 3: The exam is closed book and closed notes. You may use your ECE 214 Laboratory Notebook, a ruler, and a calculator.

Rule 4: To receive credit for an answer, include the units along with the numerical answer.

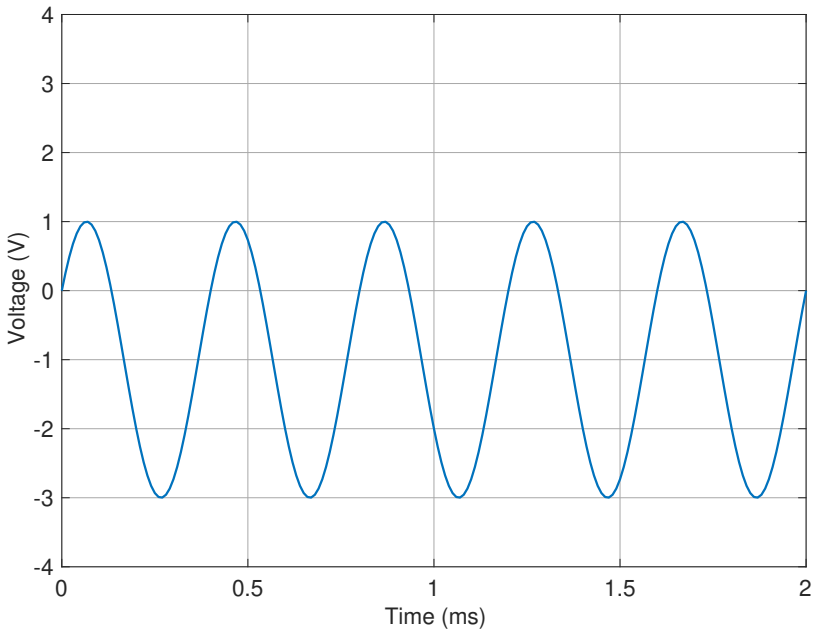
Rule 5: Show all work - answers without supporting work will not receive credit.

Rule 6: Do not leave the room until you have completed the exam.

_____

Name

Problem 1 (6 points): Consider the voltage signal V(t) shown below:



This signal can be described as:

$$\mathrm{V(t)} = A_1 \cos(\omega_1 t + \phi_1) + V_{DC1}.$$

1. What is A_1? _____

2. What is ω_1? _____

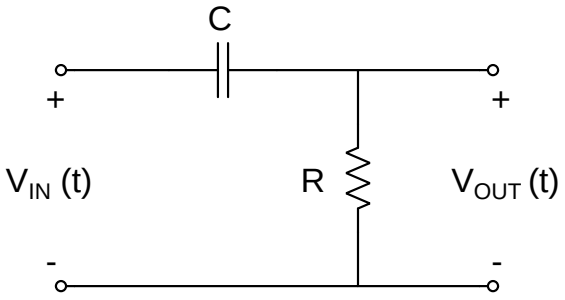
3. What is V_{DC1}? _____

4. What is ϕ_1 in degrees? _____

5. What is ϕ_1 in radians? _____

6. If V(t) is measured using a DVM with a 5 MΩ input resistance, and set to measure an AC voltage, what voltage would the DVM measure? _____

Problem 2 (6 points): In the filter circuit shown below, C = 400 pF and R = 80 kΩ.



The voltage input signal $\mathrm{V_{IN}}(t)$ is given by:

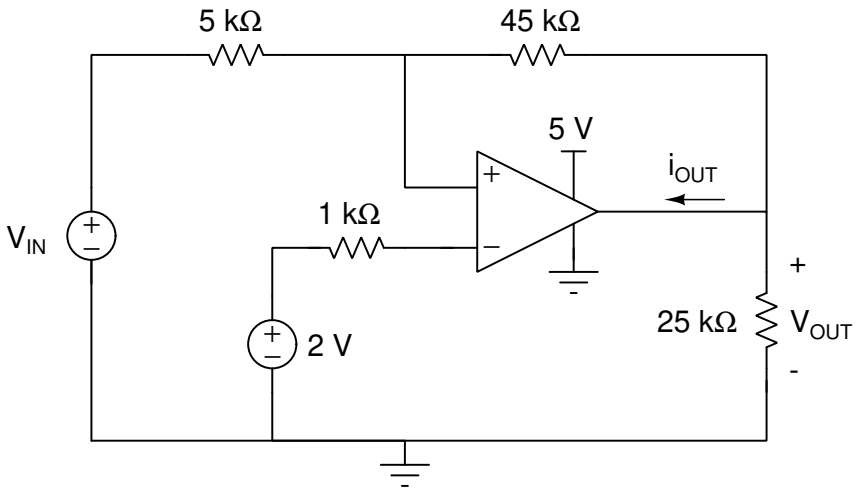
$$\mathrm{V_{IN}}(t) = 5\cos(9,940\pi t + 45^\circ) + 2 \text{ V},$$

and the voltage output signal $\mathrm{V_{OUT}}(t)$ by:

$$\mathrm{V_{OUT}}(t) = A_2\cos(\omega_2 t + \phi_2) + V_{DC2}$$

1. What is A_2? _____
2. What is ω_2? _____
3. What is ϕ_2? _____
4. What is V_{DC2}? _____
5. Is this circuit a high-pass, band-pass, band-reject, or low-pass filter? _____
6. If $\mathrm{V_{OUT}}(t)$ is connected to an oscilloscope having an input resistance of 1 MΩ and an input capacitance of 13 pF, with a cable having a capacitance of 27 pF, what is the approximate value of A_2 that is measured? _____

Problem 3a (4 points): Consider the OpAmp circuit shown below. The OpAmp is ideal.

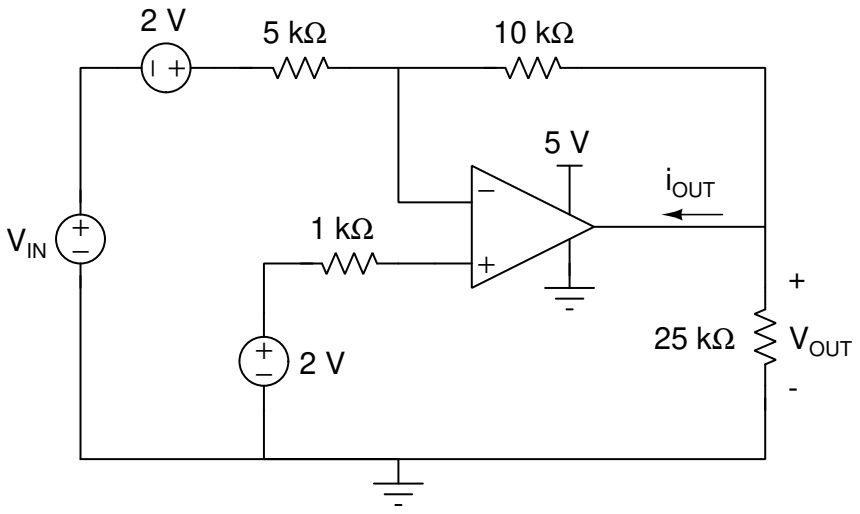


What type of circuit is this? Circle one: inverting amplifier, inverting amplifier with DC offset, noninverting amplifier, noninverting amplifier with DC offset, differentiator, integrator, Schmitt trigger.

Complete the table below:

$\mathbf{V}_{IN}$	$\mathbf{V}_{OUT}$	$\mathbf{i}_{OUT}$
0 V		
1 V		
5 V		

Problem 3b (4 points): Consider the OpAmp circuit shown below. The OpAmp is ideal.

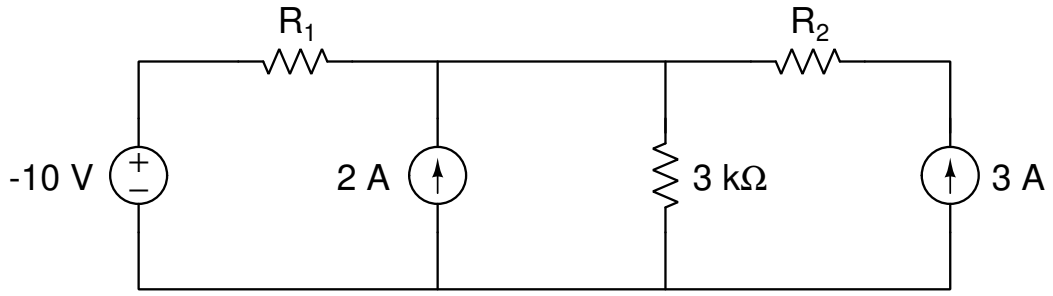


What type of circuit is this? Circle one: inverting amplifier, inverting amplifier with DC offset, noninverting amplifier, noninverting amplifier with DC offset, differentiator, integrator, Schmitt trigger.

Complete the table below:

$\mathbf{V}_{IN}$	$\mathbf{V}_{OUT}$	$\mathbf{i}_{OUT}$
0 V		
1 V		
5 V		

Bonus Question (2 points): In the circuit below, the 2A source delivers no power and absorbs no power. The circuit dissipates a total of 320 W. Determine the values of R1 and R2.



$R_1 =$ _____

$R_2 =$ _____

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Blank page for calculations. Name: _____