[PRINT]

CMPE2100 - Hardware Interfacing (A01.1242),
Ethan Frank, 1/26/25 at 9:51:51 AM MST

Question1: *Score 1/1*

An op amp has an open loop gain of 5,000,000. What is that in dB?

Your response	Correct response
134	

Auto graded **Grade:** 1/1.0

dB

Total grade: 1.0×1/1 = 100%

Question2: *Score 1/1*

Determine the gain, in V/V, for a gain stated as 80 dB.

Your response	Correct response
10000	

Auto graded **Grade:** 1/1.0

Total grade: 1.0×1/1 = 100%

Question3: *Score 3/3*

An amplifier has input voltages of V_+ = 3.0 V and V_- = 3.2 V.

1. What is the Common Mode voltage of this signal?

Your response	Correct response
3.1	

Auto graded **Grade:** 1/1.0

V

- What is the Differential voltage of this signal?

Your response	Correct response
-0.2	

Auto graded **Grade:** 1/1.0

V

- The amplifier has a differential gain of 10 and a common mode gain of 0.1. What is the expected output voltage?

Your response	Correct response
-1.69	

Auto graded **Grade:** 1/1.0

V

Total grade: 1.0×1/3 + 1.0×1/3 + 1.0×1/3 = 33% + 33% + 33%

Question4: *Score 2/2*

An amplifier has a CMR of 100 dB and a differential gain of 200 V/V.

1. What is its CMRR?

Your response	Correct response
100000	

Auto graded **Grade:** 1/1.0

- What is its common mode gain?

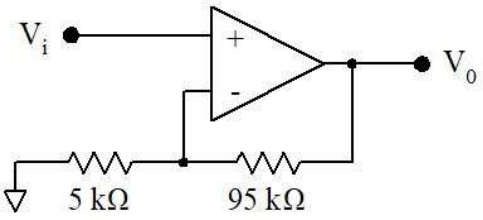
Your response	Correct response
0.002	

Auto graded **Grade:** 1/1.0

Total grade: 1.0×1/2 + 1.0×1/2 = 50% + 50%

Question5: *Score 1/1*

Determine the voltage gain for the following circuit. Include both magnitude and polarity.



A_v =

Your response	Correct response
20	

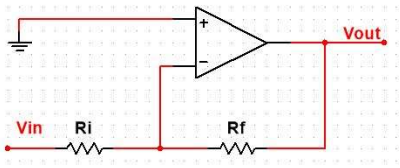
Auto graded **Grade:** 1/1.0

Total grade: 1.0×1/1 = 100%

Question6: *Score 3/3*

An inverting amplifier has Ri = 10 kΩ and Rf = 50 kΩ.

1. Select the correct circuit diagram for this amplifier.

Your response	Correct response
	

Auto graded **Grade:** 1/1.0

2. Determine the voltage gain. Indicate both magnitude and polarity.

Your response	Correct response
-5	

Auto graded **Grade:** 1/1.0

- The input signal is defined as $v_{i(t)} = 2\ \sin(200\ \pi t),\ V$. Select the correct expression for the output signal.

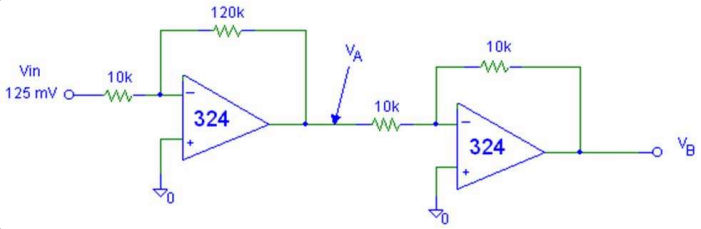
Your response	Correct response
$v_{out} = 10\ \sin(200\ \pi t + \pi),\ V$	

Auto graded **Grade:** 1/1.0

Total grade: 1.0×1/3 + 1.0×1/3 + 1.0×1/3 = 33% + 33% + 33%

Question7: *Score 4/4*

Use the following schematic to answer the questions below.



1. What is the gain of the first stage?

Your response	Correct response
-12	

Auto graded **Grade:** 1/1.0

- What voltage will appear at V_A?

Your response	Correct response
-1.5	

Auto graded **Grade:** 1/1.0

V

- What is the gain of the second stage?

Your response	Correct response
-1	

Auto graded **Grade:** 1/1.0

- What voltage will appear at V_B?

Your response	Correct response
1.5	

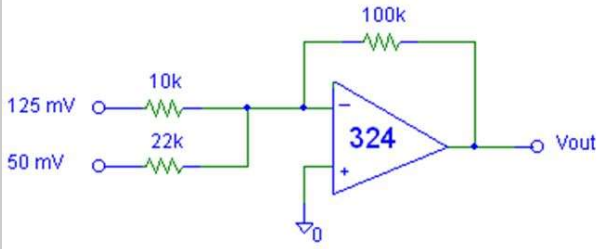
Auto graded **Grade:** 1/1.0

V

Total grade: 1.0×1/4 + 1.0×1/4 + 1.0×1/4 + 1.0×1/4 = 25% + 25% + 25% + 25%

Question8: *Score 1/1*

Calculate V_{out} for the following circuit:



V_{out} =

Your response	Correct response
-1.48	

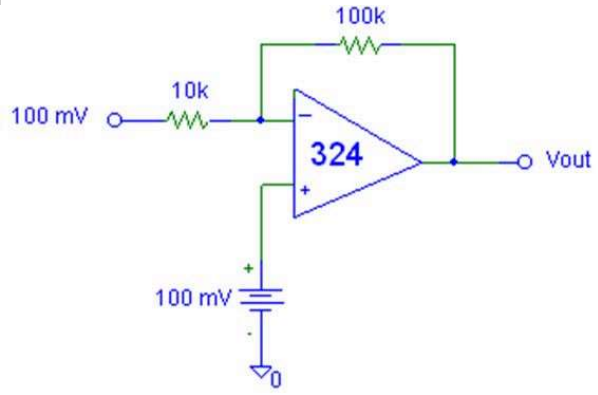
Auto graded **Grade:** 1/1.0

V

Total grade: 1.0×1/1 = 100%

Question9: *Score 1/1*

Determine V_{out} for the following circuit.



V_{out} =

Your response	Correct response
100	

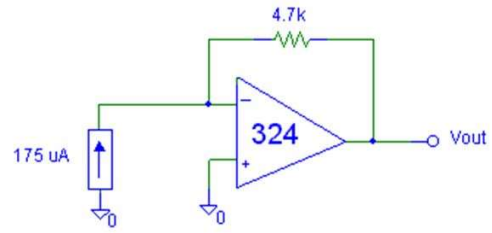
Auto graded **Grade:** 1/1.0

mV

Total grade: 1.0×1/1 = 100%

Question10: *Score 1/1*

Determine V_{out} for the following circuit.



V_{out} =

Your response	Correct response
-822.5	

Auto graded **Grade:** 1/1.0

mV

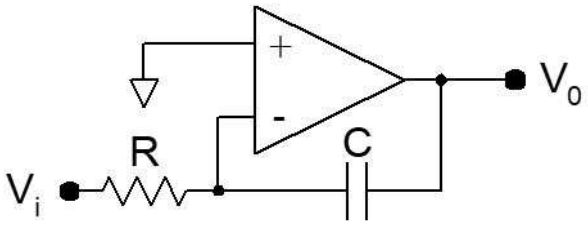
Total grade: 1.0×1/1 = 100%

Question11: *Score 2/2*

An ideal integrator has an input resistor of 1 kΩ and a feedback capacitor of 1 μF. The input is connected to +5 VDC.

1. Select the correct schematic for this circuit.

Your response	Correct response



Auto graded **Grade:** 1/1.0

2. If the output voltage at t=0 is 0 V, what will it be at t = 1.0 ms?

Your response	Correct response
-5	

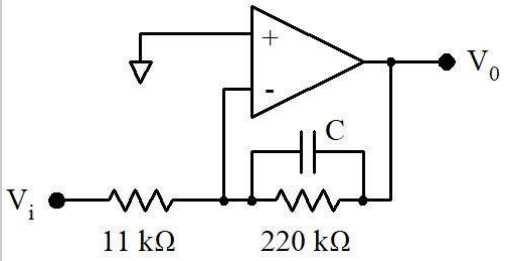
Auto graded **Grade:** 1/1.0

V

Total grade: 1.0×1/2 + 1.0×1/2 = 50% + 50%

Question12: *Score 4/4*

Use this schematic diagram to answer the questions that follow.



1. What capacitance is required for a cut-off frequency of 10 Hz? (Just enter the calculated value, not the nearest available capacitor.)

Your response	Correct response
72.3	

Auto graded **Grade:** 1/1.0

nF

- What is the expected roll-off rate for this circuit at high frequencies?

Your response	Correct response
-20 dB/decade	

Auto graded **Grade:** 1/1.0

- What is the circuit gain for a DC input signal?

Your response	Correct response
-20	

Auto graded **Grade:** 1/1.0

- What is the circuit gain for a 1 kHz signal?

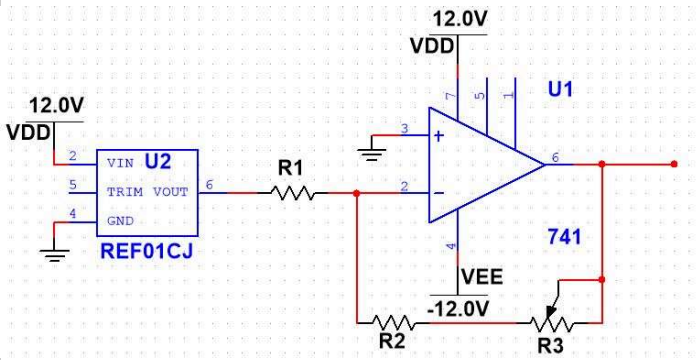
Your response	Correct response
-0.2	

Auto graded **Grade:** 1/1.0

Total grade: 1.0×1/4 + 1.0×1/4 + 1.0×1/4 + 1.0×1/4 = 25% + 25% + 25% + 25%

Question13: *Score 3/3*

Use the schematic below to answer the following questions.



1. Select a value for R1 that will draw 500 μA from the REF01.

Your response	Correct response
20	

Auto graded **Grade:** 1/1.0

kΩ

- What should the combined resistance of R2 and R3 be, if the output is to be -2.5 V?

Your response	Correct response
5	

Auto graded **Grade:** 1/1.0

kΩ

- If R3 is a 1 kΩ potentiometer, select a standard 10% resistor value for R2.

Your response	Correct response
4.7	

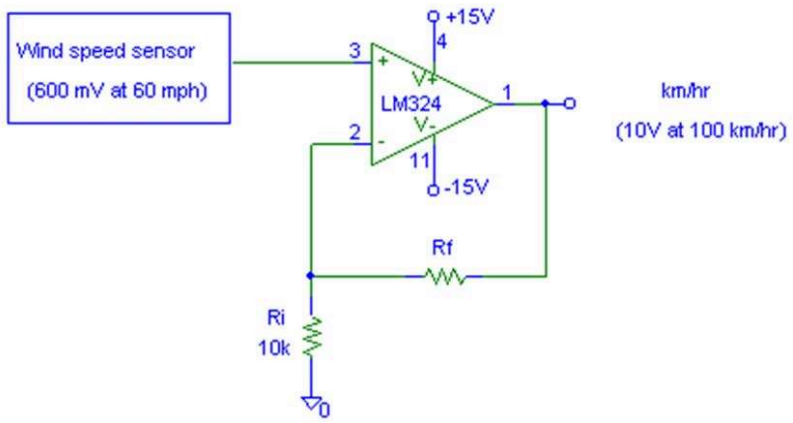
Auto graded **Grade:** 1/1.0

kΩ

Total grade: 1.0×1/3 + 1.0×1/3 + 1.0×1/3 = 33% + 33% + 33%

Question14: *Score 2/2*

Use the schematic below to answer the questions that follow.



1. Given the sensitivity shown (600 mV at 60 mph) and the desired output (10 V at 100 km/h), determine the required resistance for Rf (just calculate the required resistance -- don't pick the nearest standard value).

Your response	Correct response
151	

Auto graded **Grade:** 1/1.0

kΩ

- If Rf is broken into a 50 kΩ potentiometer and a standard 10% value fixed resistor, what would that resistor be?

Your response	Correct response
120	

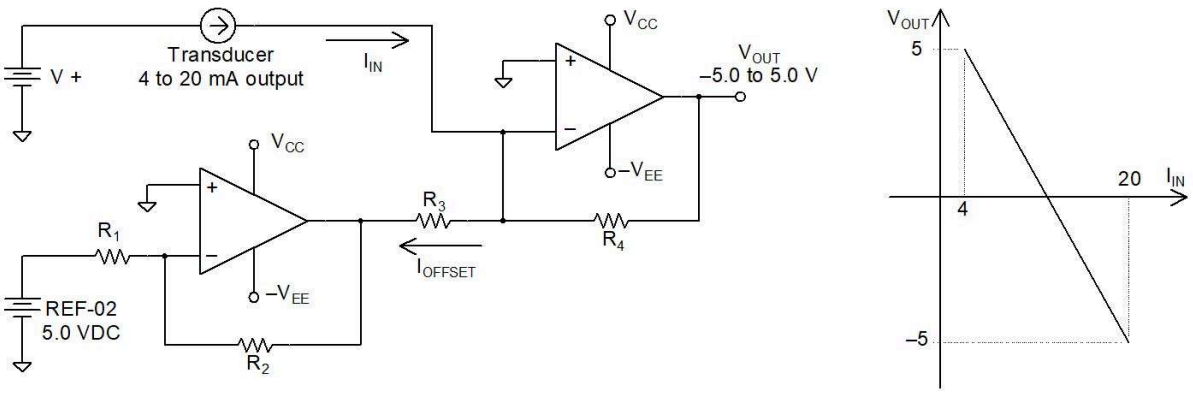
Auto graded **Grade:** 1/1.0

kΩ

Total grade: 1.0×1/2 + 1.0×1/2 = 50% + 50%

Question15: *Score 5/6*

Use the partially-complete schematic below to anwer the questions that follow.



1. Given that the input is a standard 4 mA to 20 mA loop and the output is expected to range between +5.0 V and -5.0 V respectively as shown, determine the gain of this circuit, in volts per amp.

Your response	Correct response
-625	**-625**

Auto graded **Grade:** 1/1.0

V/A

- What should the resistance of R4 be? Provide the actual calculated value, not the nearest standard value.

Your response	Correct response
625	**625**

Auto graded **Grade:** 1/1.0

Ω

- In order for the output voltage to be zero in the middle of the input span, what must I_{OFFSET} be?

Your response	Correct response
12	**12**

Auto graded **Grade:** 1/1.0

mA

- Pick a value for R1 which will draw 500 μA from the REF-02.

Your response	Correct response
10	**10**

Auto graded **Grade:** 1/1.0

kΩ

- Pick a value for R2 that will give the op amp connected to the REF-02 a gain of -1.0.

Your response	Correct response
	10

Auto graded **Grade:** 0/1.0

kΩ

- Now determine the value for R3 that will draw the appropriate offset current. Again, just supply the calculated value -- don't pick a standard resistor value.

Your response	Correct response
417	**417±2**

Auto graded **Grade:** 1/1.0

Ω

The final steps in this design would be to pick fixed resistor/potentiometer pairs for R3 and R4 to allow for fine-tuning. We won't take you through that part of the exercise.

Total grade: 1.0×1/6 + 1.0×1/6 + 1.0×1/6 + 1.0×1/6 + 0.0×1/6 + 1.0×1/6 = 17% + 17% + 17% + 17% + 0% + 17%

Question16: *Score 1/1*

Calculate the gain of an INA114 if the external resistor is 820 Ω.

Your response	Correct response
62	

Auto graded **Grade:** 1/1.0

Total grade: 1.0×1/1 = 100%

Question17: *Score 2/2*

An INA114 is used to create a gain of 20.

1. What gain resistance is needed? Just provide the calculated answer -- don't pick a standard resistor value.

Your response	Correct response
2.6	

Auto graded **Grade:** 1/1.0

kΩ

- If a 500 Ω potentiometer is chosen as a trim pot for the gain, what fixed resistor should be selected, using the 10% standard values?

Your response	Correct response
2.2	

Auto graded **Grade:** 1/1.0

kΩ

Total grade: 1.0×1/2 + 1.0×1/2 = 50% + 50%

Question18: *Score 2/2*

An AMP01 instrumentation amplifier is to be used in a circuit requiring a gain of 5.

1. What should R_S be?

Your response	Correct response
10	

Auto graded **Grade:** 1/1.0

kΩ

- What should R_G be?

Your response	Correct response
40	

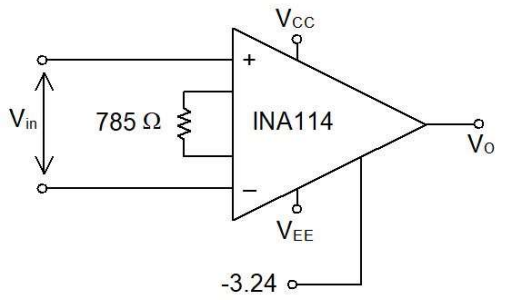
Auto graded **Grade:** 1/1.0

kΩ

Total grade: 1.0×1/2 + 1.0×1/2 = 50% + 50%

Question19: *Score 1/1*

What is the transfer function produced by the following INA114 circuit?



$v_O =$

Your response	Correct response
64.7	

Auto graded **Grade:** 1/1.0

$\cdot V_{in} -$

Your response	Correct response
3.24	

Auto graded **Grade:** 1/1.0

, V

Total grade: 1.0×1/2 + 1.0×1/2 = 50% + 50%

Question20: *Score 3/3*

A transducer produces an input signal ranging from -100 mV to +200 mV. The AtoD converter to be fed by an SCC connected to this circuit has an input range of -7.5 V to +7.5 V.

1. What gain does this amplifier require?

Your response	Correct response
50	

Auto graded **Grade:** 1/1.0

- What gain resistance is needed to produce this gain on an INA114? Don't pick a standard resistance -- just provided the calculated value.

Your response	Correct response
1.01	

Auto graded **Grade:** 1/1.0

$\mathrm{k}\Omega$

- What offset voltage should be applied to pin 5 of the INA114?

Your response	Correct response
-2.5	

Auto graded **Grade:** 1/1.0

V

Total grade: 1.0×1/3 + 1.0×1/3 + 1.0×1/3 = 33% + 33% + 33%

Question21: *Score 4/4*

A transducer signal ranges from -100 mV to +20 mV. The output of the SCC for this signal is to range from 0 to 3 V.

1. What is the required gain for the SCC?

Your response	Correct response
25	

Auto graded **Grade:** 1/1.0

- What offset voltage is required?

Your response	Correct response
2.5	

Auto graded **Grade:** 1/1.0

V

- What gain resistance would be needed, if an INA114 is to be used?

Your response	Correct response
2.08	

Auto graded **Grade:** 1/1.0

kΩ

- If a 500 Ω potentiometer is used to trim the gain, what should the fixed resistor be, from the list of standard 10% values?

Your response	Correct response
1.8	

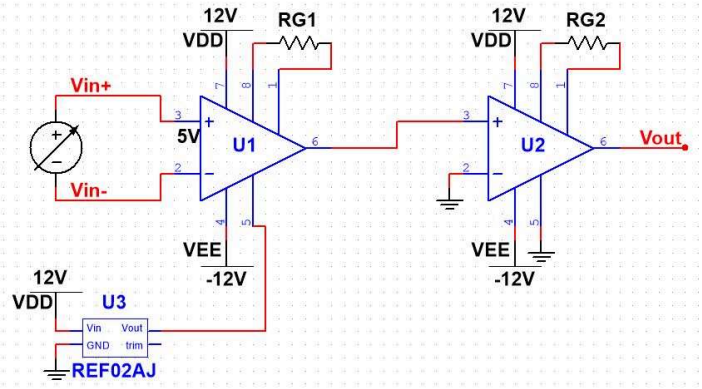
Auto graded **Grade:** 1/1.0

kΩ

Total grade: 1.0×1/4 + 1.0×1/4 + 1.0×1/4 + 1.0×1/4 = 25% + 25% + 25% + 25%

Question22: *Score 2/2*

The desired transfer function for an SCC is $V_{out} = 3000\ V_{in} + 30$, V. Unfortunately, providing an offset voltage of 30 V directly to an INA114 will burn out the IC, as it is outside of the operational range. The following schematic, using two INA114 instrumentation amplifiers, can be designed to produce this transfer function. Pick suitable values for the two feedback resistors to satisfy the requirements of this design.



R_{G1} =

Your response	Correct response
100	

Auto graded **Grade:** 1/1.0

Ω

R_{G2} =

Your response	Correct response
10	

Auto graded **Grade:** 1/1.0

kΩ

Total grade: 1.0×1/2 + 1.0×1/2 = 50% + 50%