Instructions:
- This quiz lasts 30 minutes. Answer all questions (on both sides of the sheet)
- You may have a 8.5” × 11” sheet of notes and a non-network-connected calculator

Q1a: Op amps are ideal, with power supply, \( V_{EE} = -15 \, \text{V} \) and \( V_{CC} = 15 \, \text{V} \). At \( t = 0 \) there is no change on capacitors.

1. (5 marks) When \( V_i \) is as shown below, sketch the output, \( V_A \), on the lower graph. Indicate voltage levels.

2. (5 marks) Sketch the output, \( V_o \), on the same graph. Indicate voltage levels (to within 1% accuracy) and calculate any time-constants.
Q2a: Consider the following instrumentation amplifier:

(a) (5 marks) Initially all resistors except $R_G$ are 10 kΩ. Calculate $R_G$ so that the differential gain ($A_d$) is 100.

(b) (5 marks) Calculate the common-mode gain ($A_{cm}$) when the resistor values are as shown.
Instructions:
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Q1b: Op amps are ideal, with power supply, $V_{EE} = -15 \text{ V}$ and $V_{CC} = 15 \text{ V}$. At $t = 0$ there is no change on capacitors.

1. (5 marks) When $V_i$ is as shown below, sketch the output, $V_A$, on the lower graph. Indicate voltage levels.

2. (5 marks) Sketch the output, $V_o$, on the same graph. Indicate voltage levels (to within 1% accuracy) and calculate any time-constants.
Q2b: (10 marks) Consider the following instrumentation amplifier:

(a) Initially all resistors except $R_G$ are 20 kΩ. Calculate $R_G$ so that the differential gain ($A_d$) is 200.
(b) Calculate the common-mode gain ($A_{cm}$) when the resistor values are as shown.
Instructions:
• This quiz lasts 30 minutes. Answer all questions (on both sides of the sheet)
• You may have a 8.5” × 11” sheet of notes and a non-network-connected calculator

Q1c: Op amps are ideal, with power supply, \( V_{EE} = -15 \text{ V} \) and \( V_{CC} = 15 \text{ V} \). At \( t = 0 \) there is no change on capacitors.

1. (5 marks) When \( V_i \) is as shown below, sketch the output, \( V_A \), on the lower graph. Indicate voltage levels.

2. (5 marks) Sketch the output, \( V_o \), on the same graph. Indicate voltage levels (to within 1% accuracy) and calculate any time-constants.
Q2c: (10 marks) Consider the following instrumentation amplifier:

(a) Initially all resistors except $R_G$ are 5 kΩ. Calculate $R_G$ so that the differential gain ($A_d$) is 100.
(b) Calculate the common-mode gain ($A_{cm}$) when the resistor values are as shown.