

## ME 360: FUNDAMENTALS OF SIGNAL PROCESSING, INSTRUMENTATION, AND CONTROL

### Experiment No. 3 Noise Reduction Techniques, Instrumentation Amplifiers, and Strain Gage Measurements Pre-lab Questions

These short answer questions must be completed and turned in at the beginning of the laboratory period.

1. What two types of noise are studied in this experiment? (2 pts)
2. For each of the following noise sources, identify which of the two types of noise studied in this experiment will most likely dominate. (5 pts)
  - (a) 120 VAC power line carrying 5 A
  - (b) a switching motor controller
  - (c) a 5-hp electric motor
  - (d) an FM radio station transmitting at 97.5 MHz
  - (e) a personal computer next to a force transducer
3. What type of noise is shielding effective against? What type of noise is twisted-pair cabling effective against? (2 pts)
4. What is the purpose of the tape head demagnetizer in this experiment? (2 pts)
5. State the general amplifier equation. (2 pts)
6. Explain step-by-step how to determine the two unknown parameters of the general amplifier equation when  $G = 1$  by varying  $V^+$  and  $V^-$  (4 pts)

7. Define common-mode rejection ratio (CMRR) both conceptually and mathematically. (2 pts)
8. How is the gain of the AD620 instrumentation amplifier set? What is the nominal value of gain resistance used in this experiment? What nominal gain does this correspond to? (3 pts)
9. What are manufacturer's specifications for the AD620AN in terms of the following parameters? Be sure to include proper units. (4 pts)
- |                                |       |                                     |       |
|--------------------------------|-------|-------------------------------------|-------|
| Minimum gain                   | _____ | Maximum Output Offset ( $\pm 15V$ ) | _____ |
| Typical Gain Nonlinearity      | _____ | CMRR at $G = 100$                   | _____ |
| Minimum Power Supply Voltage   | _____ | Maximum Power Supply Voltage        | _____ |
| Maximum Gain Error at $G = 10$ | _____ | Typical Input Impedance             | _____ |
10. How many gages are installed on the cantilever beam? What bridge configuration (quarter, half, or full) is used? (2 pts)
11. Sketch the bridge circuit used for the strain gage measurements in this experiment. Identify the strain gages, the fixed resistors, the bridge-zeroing potentiometer and the operational amplifier. Do not include the connections on the circuit board or to the amplifier package. Rather use only those elements that would be part of a standard circuit schematic. (2 pts)