## Input – Output Device

1. Decide whether each of these statements is true (T) or false (F). A limit switch:

(i) Can be used to detect the presence of a moving part

(ii) Is activated by contacts making or breaking an electrical circuit.

A. (i) True, (ii) True

B. (i) True, (ii) False

C. (i) False, (ii) True

D. (i) False, (ii) False

1. Decide whether each of these statements is true (T) or false (F). A thermistor is a temperature sensor that gives resistance changes that are:

(i) A nonlinear function of temperature.

(ii) Large for comparatively small temperature changes

A. (i) True, (ii) True

B. (i) True, (ii) False

C. (i) False, (ii) True

D. (i) False, (ii) False

1. Decide whether each of these statements is true (T) or false (F). Input devices that give an analog input for displacement include a:

(i) Linear potentiometer

(ii) Linear variable differential transformer

A. (i) True, (ii) True

B. (i) True, (ii) False

C. (i) False, (ii) True

D. (i) False, (ii) False

1. Decide whether each of these statements is true (T) or false (F). A stepper motor has a step angle of 1.8o. This means that:

(i) Each pulse input to the motor rotates the motor shaft by 1.8o

(ii) The motor shaft takes 1 s to rotate through 1.8o

A. (i) True, (ii) True

B. (i) True, (ii) False

C. (i) False, (ii) True

D. (i) False, (ii) False

1. A stepper motor has a step angle of 7.5. The digital input rate required to produce a rotation of 10 rev/s is:
2. 48 pulses per second
3. 75 pulses per second
4. 480 pulses per second
5. 750 pulses per second
6. Decide whether each of these statements is true (T) or false (F). A proximity switch is required for detecting the presence of a nonmetallic object. Types of switches that might be suitable are:

(i) Eddy current type.

(ii) Capacitive type.

A. (i) True, (ii) True

B. (i) True, (ii) False

C. (i) False, (ii) True

D. (i) False, (ii) False

1. Explain how the on/off operation and direction of a DC motor can be controlled by switches.
2. Explain the principle of the stepper motor and state the different types available.
3. Select sensors that might be suitable for the following applications:

(a) counting boxes moving along a conveyor belt,

(b) verifying the level of milk in a plastic bottle moving along a conveyor belt,

(c) determining when the piston in a cylinder has reached a particular point in its extension; (d) determining when a metal plate has reached the right position under a tool.

1. A range of opaque bottles of various sizes moves along a conveyor belt. Suggest a method that could be used to (a) detect the different sizes and (b) push bottles off the belt.

## I-O Processing

1. An ADC is used to sample the output voltage from a pressure sensor. If the output from the sensor is 0 V when the pressure is 0 kPa and 10 V when it is 10 kPa, the minimum number of ADC bits needed to resolve the sensor output if the sensor error is not to exceed 0.01 kPa is:
2. 4
3. 8
4. 10
5. 12
6. A 12-bit ADC can be used to represent analog voltages over its input range with:
7. 12 different binary numbers
8. 24 different binary numbers
9. 144 different binary numbers
10. 4096 different binary numbers
11. For an analog input range of 0 to 10 V, the minimum size ADC needed to register a change of 0.1 V is:
12. 4-bit
13. 6 bit
14. 8 bit
15. 12-bit
16. An inverting operational amplifier circuit has an input resistance of 10 k ohm and feedback resistance of 100 k ohm. The closed-loop gain of the amplifier is:
17. -100
18. -10
19. +10
20. +100

Problems 15 and 16 refer to an operational amplifier with a closed loop gain of 100 and an input

resistance of 47 k ohm

1. The feedback resistor for an inverting op-amp amplifier will be:
2. 4.65 k ohm
3. 4.7 k ohm
4. 465 k ohm
5. 470 k ohm
6. The feedback resistor for a noninverting op-amp amplifier will be:
7. 4.65 k ohm
8. 4.7 k ohm
9. 465 k ohm
10. 470 k ohm
11. Decide whether each of these statements is true (T) or false (F). A serial communication interface:

(i) Involves data being transmitted and received one bit at a time.

(ii) Is a faster form of transmission than parallel communication

A. (i) True, (ii) True

B. (i) True, (ii) False

C. (i) False, (ii) True

D. (i) False, (ii) False

Problems 18 and 19 refer to the following, which shows the bits on an RS232 data line being

used to transmit the data 1100001:

0110000111

X YZ

1. Decide whether each of these statements is true (T) or false (F). The extra bits X and Z at the beginning and the end are:

(i) To check whether the message is corrupted during transmission.

(ii) To indicate where the data starts and stops.

A. (i) True, (ii) True

B. (i) True, (ii) False

C. (i) False, (ii) True

D. (i) False, (ii) False

1. Decide whether each of these statements is true (T) or false (F). Bit Y is:

(i) The parity bit showing odd parity.

(ii) The parity bit showing even parity

A. (i) True, (ii) True

B. (i) True, (ii) False

C. (i) False, (ii) True

D. (i) False, (ii) False

1. Decide whether each of these statements is true (T) or false (F). The parallel data communication interface:

(i) Enables data to be transmitted over short distances at high speeds.

(ii) Has a common standard known as IEEE-488.

A. (i) True, (ii) True

B. (i) True, (ii) False

C. (i) False, (ii) True

D. (i) False, (ii) False

1. Decide whether each of these statements is true (T) or false (F). For communications over distances of the order of 100 to 300 m with a high transmission rate:

(i) The RS232 interface can be used.

(ii) The 20 mA current loop can be used.

A. (i) True, (ii) True

B. (i) True, (ii) False

C. (i) False, (ii) True

D. (i) False, (ii) False

1. Specify (a) the odd parity bit and (b) the even parity bit to be used when the data 1010100 is transmitted.
2. Explain the purpose of using a parity bit.
3. What input resistance and feedback resistance can be used with an inverting operational amplifier circuit to give a gain of –100?
4. Compare the star, bus and ring forms of network and the methods used to avoid problems with messages.