

MID TERM EXAM

ROBOTICS ELECTRICAL SYSTEMS

DURATION: 80 Minutes

DATE: March 10, 2025

Humber College & Sault College

STUDENT NAME: _____

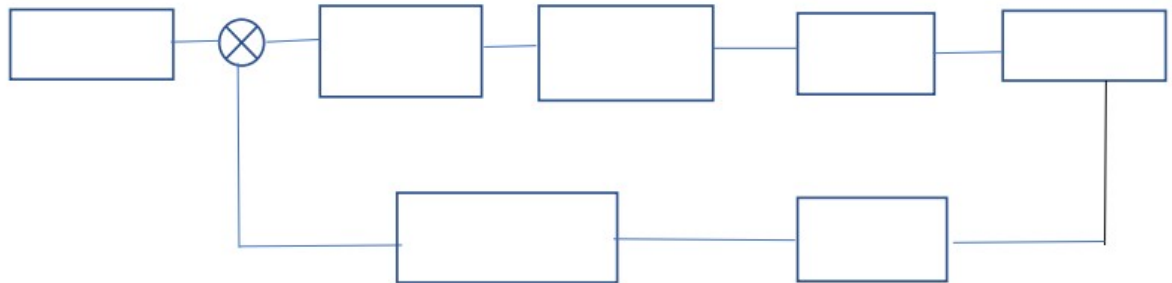
STUDENT ID: _____

Part A: Answer the following Questions and solve the problems. (40 marks)

Q1. If an optical encoder has 10 slits and it gives 8 output pulses then determine the angular displacement (in degrees) of the joint where the encoder is attached. If it gives 300 pulses in 2 minutes, then also calculate the speed of the joint in rev per sec (rps). (5)

Q2. An optical disk (with 8 slits) is mounted on a mobile robot. If the diameter of the optical disk is 120 mm and the output pulses are counted as 320, then calculate the linear displacement of the mobile robot. (Assume the wheel diameter is the same as the optical disk diameter). (5)

Q3. Describe the servomechanism and identify the key elements of the servo control system to fit in the given servo close loop diagram and describe the functionality of each element. (10)

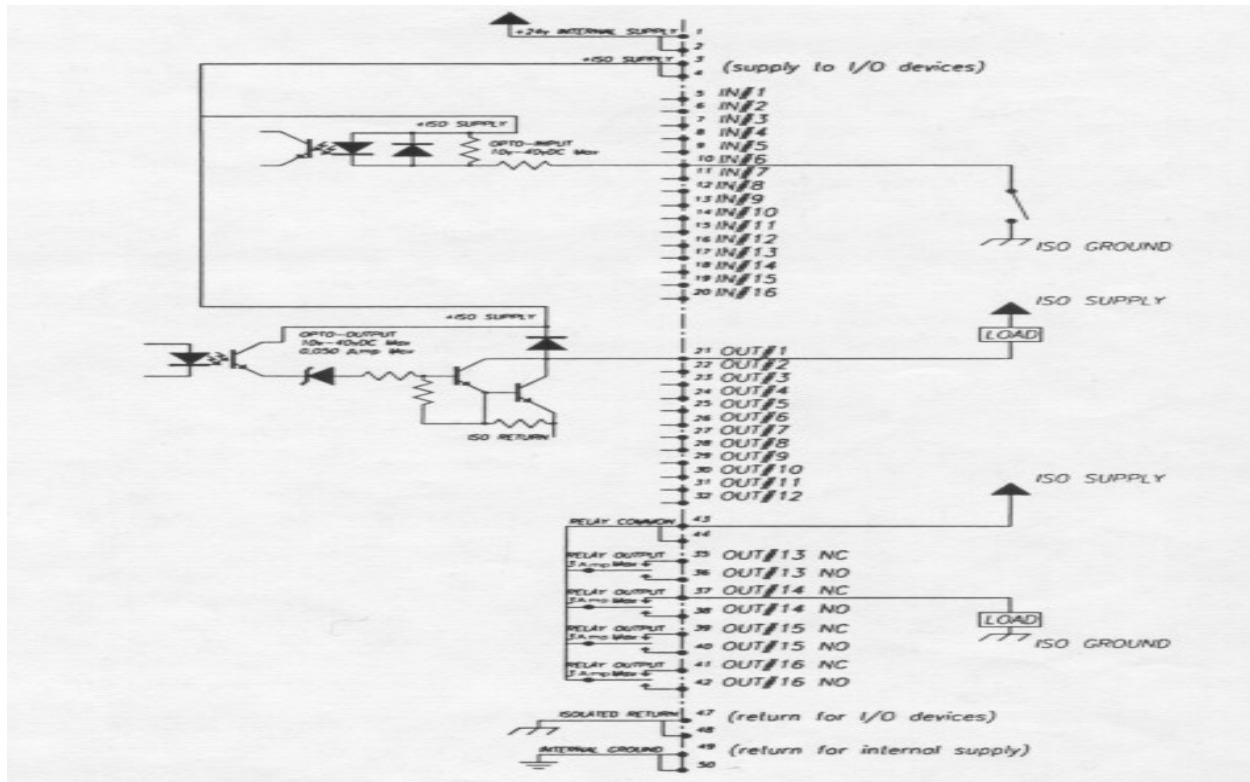


Q4. Identify the use of following sensors in robotic system (Critical Thinking) (5)

Type of sensor	Applications in Robotic & Automation
Potentiometer	
Capacitive sensor	
Inductive sensor	
Proximity Sensor	
Light sensors	
Infrared Sensors	
Encoders	
Gyroscope sensor	

Q5. Differentiate the sinking and sourcing devices and why it is important to identify them before connecting to the input and output card. (5)

Q6. Draw the wiring diagram of input and output cards based on the given manufacture wiring diagram also trace the line to identify the type of card (sinking or sourcing). (10)



Part B : Multiple Choice Questions, Some questions have multiple answers, marked as multiple answers. (20 Marks)

1. An incremental encoder has the following type of disk
 - a. Opaque disk
 - b. Disk with multiple slits**
 - c. Optical disk
 - d. All of the above

2. A Sourcing card connects with _____ to complete the electrical circuit.
 - a. Sinking Devices**
 - b. Sourcing Devices
 - c. Input devices
 - d. Output devices

3. Sourcing devices connect with _____ terminal of an electrical circuit.
 - a. Power terminal (positive terminal)**
 - b. Ground terminal (negative terminal)
 - c. No connection required.
 - d. Neutral

4. During a Joint movement the robot joints or axes move
 - a) In the same direction
 - b) Slower than all other movement types
 - c) Independent of each other**
 - d) In opposite directions

5. Hard Automation includes the following: (Multiple answers)
 - a) Specific task machines**
 - b) Highly precise and reliable**
 - c) Work for small production
 - d) Costly Re tooling**
 - e) Reprogrammable

6. A device that prevents an end effector from moving beyond a certain point is a(n) _____.
 - a. Compiler
 - b. end stop**
 - c. manual rate control box
 - d. Subroutine

7. "The changing of values of one of these coordinates (X, Y or Z) causes the robot to move several of its joints at the same time" this statement is true for _____
(Multiple answers)

- a) **User coordinate system**
- b) Joint coordinate system
- c) **World Coordinate system**

8. A Servo Robot is the example of following control systems (Multiple answers)

- a) Open Loop Control System
- b) **Close Loop Control System**
- c) **Continue Feedback system**
- d) Limited feedback system

9. Which type of controlled movement is slow and precise?

- a. **Move L**
- b. Move J
- c. Move J with Reduced Accuracy
- d. Move L with reduced Accuracy

10. Features of Non-Servo Robots are (Multiple answers)

- a) Complicated
- b) **Fixed Stop Robot**
- c) Error detectors
- d) Expensive
- e) **Easy to use**

11. The resolution of an incremental encoder with 12 slits is _____ degrees

- a. 28
- b. **30**
- c. 32
- d. 36

12. A servo amplifier is able to perform the following tasks: (Multiple answers)

- a. **Amplify the signals**
- b. Compare the signals
- c. **Convert the signals**
- d. Remove the error signal.

13. Which type of controlled movement is rough and faster but not accurate?

- a. Move L
- b. Move J
- c. **Move J with Reduced Accuracy**
- d. Move L with reduced Accuracy

14. Servo Robots are relatively _____ compared to non-servo robot (Multiple answers).

- a. **Expensive**
- b. In expensive
- c. **Complicated**
- d. Simple

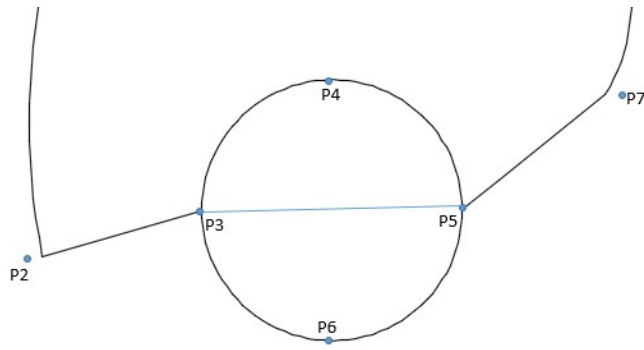
15. A comparator in a control system is able to perform the following tasks: (Multiple answers)

- a. Amplify the signals.
- b. **Compare the signals.**
- c. Convert the signals.
- d. **Calculating the error signals**

16. A robot that can detect changes in the work environment and use decision-making abilities to determine how to proceed.

- a. fixed-sequence robot
- b. variable-sequence robot
- c. playback robot
- d. Numerically controlled robot
- e. **intelligent robot**

Assume your robot is tracing the following positions as shown below Choose the correct type of motion for each points (P1-P8)? (17 - 20)



17. Identify the type of movement between two positions P8 to P7

- a. PTP
- b. PTP Linear
- c. **PTP Reduced accuracy**
- d. Linear Reduced accuracy
- e. Circular

18. Identify the type of movement between position P1 to P8

- a. PTP
- b. **Linear**
- c. PTP Reduced accuracy
- d. Linear Reduced accuracy
- e. Circular

19. Identify the type of movement between position P5 to P7

- a. PTP
- b. PTP Linear
- c. PTP Reduced accuracy
- d. **Linear Reduced accuracy**
- e. Circular

20. Identify the type of movement between position P3, P6 and P5

- a. PTP
- b. PTP Linear
- c. PTP Reduced accuracy
- d. Linear Reduced accuracy
- e. **Circular**