



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024**

- COURSE NAME : INDUSTRIAL ROBOTICS
- COURSE CODE : BND 43003
- PROGRAMME CODE : BND
- EXAMINATION DATE : JULY 2024
- DURATION : 3 HOURS
- INSTRUCTIONS :
1. ANSWER ALL QUESTIONS
 2. THIS FINAL EXAMINATION IS CONDUCTED VIA
 Open book
 Closed book
 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

- Q1** (a) What is the meaning of Industrial Robotics? (5 marks)
- (b) Explain (with example) the robotic application in these areas
(i) Manufacturing
(ii) Healthcare (5 marks)
- (c) Differentiate Industry 4.0 and Industry 5.0 features (10 marks)

Q2 (a) When it comes to the mechanical joints featured in robotic arms, there are two main types of manipulator joints. With a proper diagram and illustration, explain the types and the concept of the working principle. (8 marks)

(b) **Figure Q2.1** shows an actuated typical robot arm component equipped with servo motor. Based on your understanding of mechanical joints in robotic systems, answer the following:

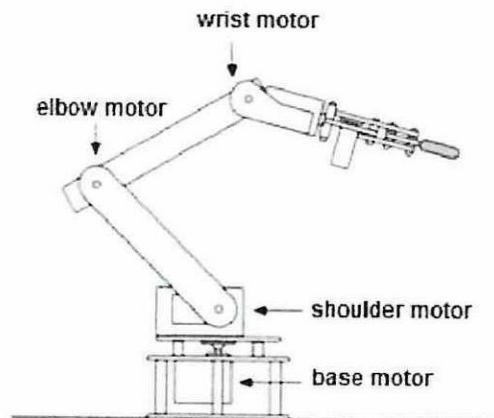


Figure Q2.1

- i. Identify and describe the four types of joints used in the robot arm illustrated. (2 marks)
- ii. Explain the degrees of freedom (DOF) each joint provides and how they contribute to the robotic arm's overall movement capability. (4 marks)
- iii. Discuss how combining these joints enables the robotic arm to perform complex tasks. Provide examples of applications where such a combination of joints would be essential. (6 marks)

Q3 (a) Understanding the work envelope is a critical concept in robotic systems before implementing or utilizing the robot.
Discuss the importance of this concept in the application of robotics in industry across five key areas.

(10 marks)

(b) Scenario: Imagine you are an engineer in a factory setting where there are boxes on a conveyor belt and an empty pallet placed on the floor next to it. The task is to transfer the boxes from the conveyor belt and arrange them neatly on the pallet as shown in **Figure Q3.1**.

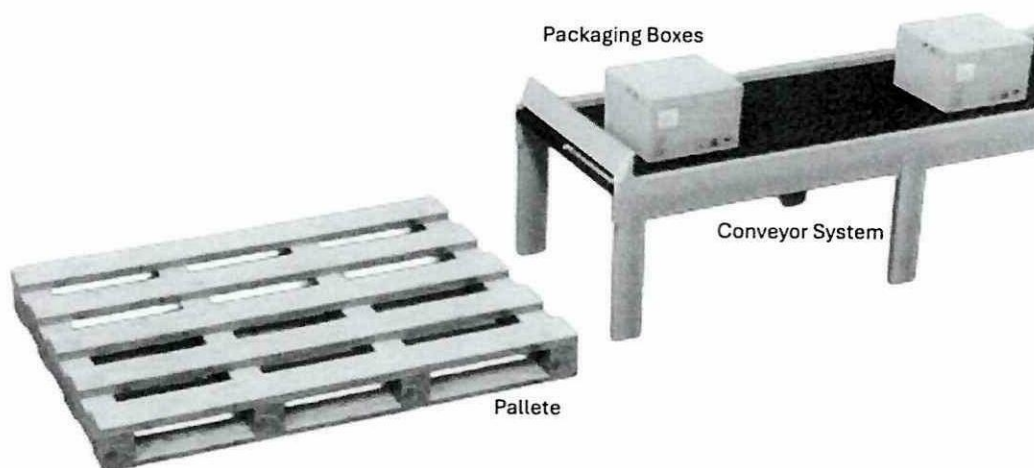


Figure Q3.1

With a proper sketching/illustration, discussion and examples. Propose a robotic system that can automate the process of picking boxes from the conveyor belt and placing them onto the pallet.

(10 marks)

- Q4** (a) There are various robotic technologies being utilized in modern manufacturing.
- i. Define a Pick and Place Robot. (2 marks)

 - ii. What are the types of Pick and Place Robots available in the current environment? (6 marks)
- (b) Sensors and controllers are two of the main components of industrial robots, particularly pick-and-place robots. By using suitable illustrations and discussion, describe three of the most common sensors and controllers used in modern industrial robots and how they can improve pick-and-place tasks. (12 marks)

- Q5** (a) Define **THREE (3)** common programming approaches used in industrial robotics. (6 marks)
- (b) The teach pendant is the most popular method for programming industrial robots. Discuss the advantages and disadvantages of this programming approach. (6 marks)
- (c) Consider the industrial robotic setup shown in **Figure Q5.1**. The robot is equipped to perform tasks on a production line.

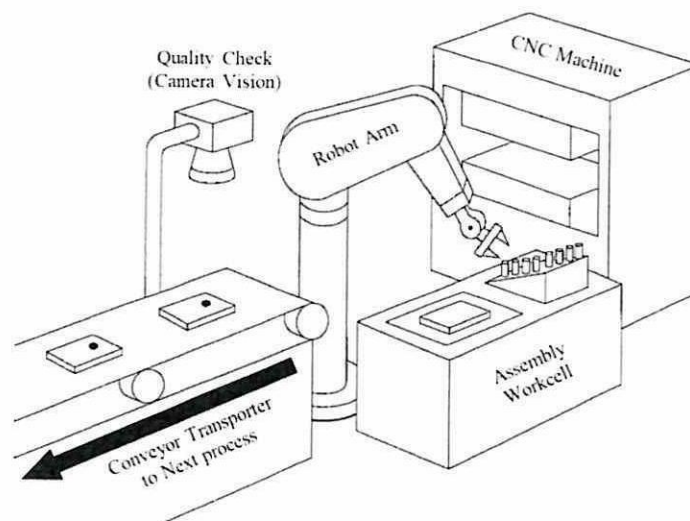


Figure Q5.1

- i) Design a pseudo-code algorithm that outlines the steps the robot would take to perform a task shown in the image, such as transferring items from one conveyor to another. (4 marks)
- ii) Discuss the potential challenges and considerations that must be addressed when programming the robot to interact with its environment and perform tasks autonomously. (4 marks)

-END OF QUESTIONS -