



---

**UNIVERSITI KUALA LUMPUR  
Malaysia France Institute**

---

**FINAL EXAMINATION  
JANUARY 2010 SESSION**

---

**SUBJECT CODE** : FAD 20302  
**SUBJECT TITLE** : INTRODUCTION TO ROBOTICS  
**LEVEL** : DIPLOMA  
**TIME / DURATION** : 9.00am – 11.00am  
( 2 HOURS)  
**DATE** : 07 MAY 2010

---

**INSTRUCTIONS TO CANDIDATES**

---

1. Please read the instructions given in the question paper **CAREFULLY**.
2. This question paper is printed on both sides of the paper.
3. Please write your answer on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This questions paper consists of **TWO (2)** sections. Section A and B. Answer **ALL** questions in section A. For Section B answer **TWO (2)** questions only.
6. Answer all questions in English.

---

**THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.**

---

## SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.

Please answers all in answer booklet provided.

## Question 1

- (a) Briefly define the word 'robot' introduced by Asimov. (2 marks)
- (b) Define an industrial robot in International Standards Organization (ISO). (5 marks)
- (c) Why we use robots rather than using human in our industry. (2 marks)
- (d) List 4A tasks in 4D environments. (8 marks)
- (e) List two applications of industrial robot. (2 marks)
- (f) Define revolute joints and state their three variations. (5 marks)

## Question 2

- (a) Describe the three laws of Robotics. (6 marks)
- (b) A strategy for limiting access to the areas is illustrated in **Figure 1**. The work cell is divided into zones 1 to 3. Define these 3 zones. (6 marks)

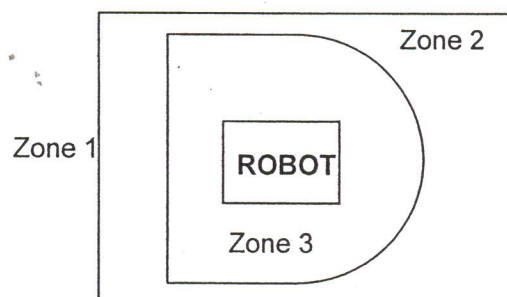


Figure 1: Safety zones

**Question 3**

- (a) There are basically three types of power sources for robots. State each of them. (6 marks)
- (b) Determine the classification of industrial robots. (4 marks)
- (c) In the context of robotics, define manipulator. (4 marks)
- (d) Define the following common terms in robotics:
- (i). Degree of Freedom (DOF). (2 marks)
  - (ii). Open Kinematic Chain (OKC) and Close Kinematic Chain (CKC). (4 marks)
  - (iii). List difference between OKC and CKC. (4 marks)

**SECTION B (Total: 40 marks)****INSTRUCTION: Answer TWO (2) questions only.****Please answers all in answer booklet provided.****Question 4**

- (a) Company A decided to have a robot system in its operation. However, management requested for the information on  $n^{\text{th}}$  year the positive profit to be seen. The cost of a robot is \$55,000, and the price of tooling and fixturing is \$30,000. The installation cost is \$15,000. Use 10% as the rate of investment. The cost of labor is \$17 per hour, and the savings in the cost of materials is \$1. The actual cost of running and maintaining the robot system is \$6. The number of hours per year shift per shift is assumed to be 2,000. Assume an annual depreciation on an 8-years tax life and the salvage value to be \$10000. Use a corporate tax rate of 40% to determine the number of years that are required to break even. (5 marks)
- (b) A cardboard carton weighing 10 pounds is held in a griper using friction against two opposing fingers. The coefficient of friction is 0.25. The weight of the carton is directed parallel to the finger surface. (6 marks)
- (i). Determine the required gripper force for the condition given.
- (ii). If SF=1.5, what would be the value of the gripper force.
- (c) State a reason why we need to consider having a safety factor on the operating gripper force. (2 marks)
- (d) Define end-effector and what function does it serve. (4 marks)
- (e) State three general requirements of end-of-arm tooling. (3 marks)

Question 5

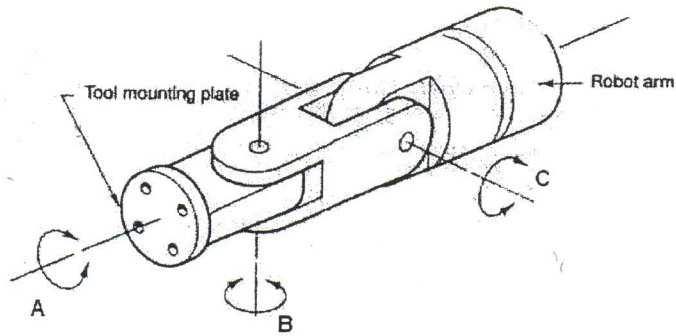


Figure 2: Robot wrist

(a) Name the orientation of axes label A, B and C shown in Figure 2.

(3 marks)

(b) Determine the degree of freedom for each figure shown in Figure 3.

(8 marks)

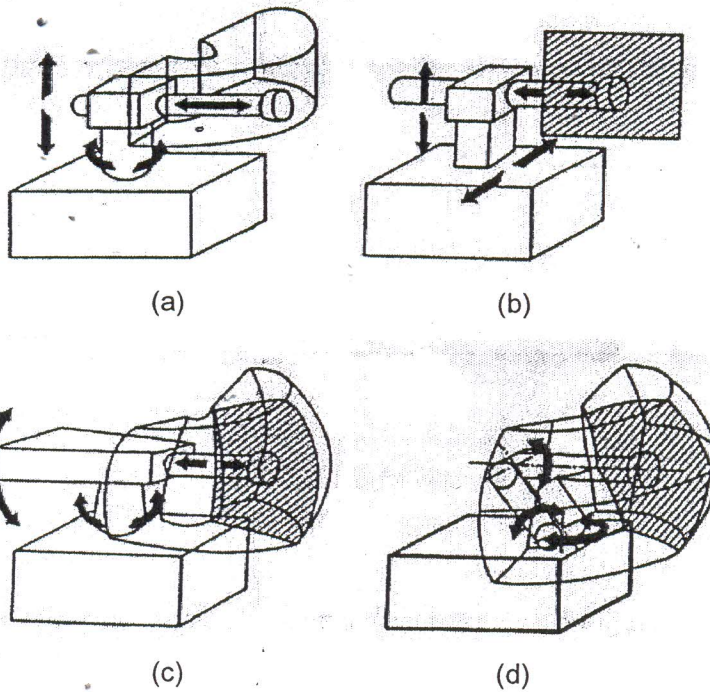


Figure 3: Robot types

(c) Classify the examples in the Figure 3 represent which type of robot configuration.

(4 marks)

(d) Give two (2) advantages and disadvantages of using robot type in Figure 3(d).

(5 marks)

Question 6

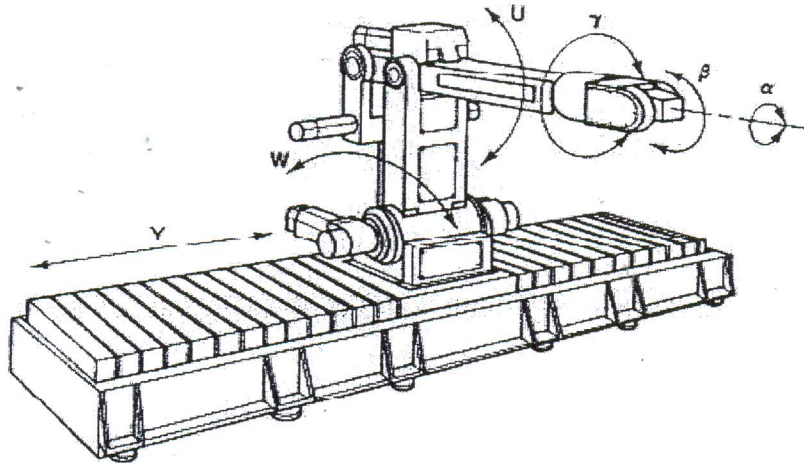


Figure 4: Elements of robot

- (a) Based on the example of the robot arm given in the **Figure 4**, answer all questions below:
- (i). Total number of joints. (2 marks)
  - (ii). Total number of links. (2 marks)
  - (iii). Degree of freedom (DOF). (2 marks)
- (b) Define the robot terms below:
- (i). Repeatability. (2 marks)
  - (ii). Orientation Axes. (2 marks)
  - (iii). Tool Centre Point. (2 marks)
- (c) Automated arc welding offers many advantages. Not only does it improve the finished weld, but it is one of the most cost-effective steps a company can take. What are the advantages of robot welding based on:
- (i). Quality (2 marks)
  - (ii). Productivity (2 marks)

(iii). Speed

(2 marks)

(iv). Reduced costs

(2 marks)

**END OF QUESTION**