



**UNIVERSITI KUALA LUMPUR
Malaysia France Institute**

**FINAL EXAMINATION
JANUARY 2014 SESSION**

SUBJECT CODE : FAB 11202
SUBJECT TITLE : ROBOTICS FUNDAMENTAL
LEVEL : BACHELOR
TIME / DURATION :
(2 HOURS)
DATE :

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 answers on the answer booklet provided.
 4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
 5. This question paper consists of **TWO (2) sections**. Section A and B. Answer all questions in Section A. For Section B, answer two (2) question only.
 6. Answer all questions in English.
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THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.

Please answers all in answer booklet provided.

Question 1

- a) Differentiate between the SCARA arm and the articulated arm geometry. What is the special feature of the SCARA arm for assembly application? (5 marks)
- b) Sketch the work envelopes of the robot configurations for each of the five types of manipulators. (5 marks)
- c) Explain and sketch type of manipulator that has the largest reach for the amount of floor space it occupies. (5 marks)
- d) Compare degree of freedom of a robot system to the human hand? (5 marks)
- e) Discuss factors to consider in the selection of a control unit for an industrial robot? (5 marks)

Question 2

- (a) Discuss **three (3)** Robot Application considerations. (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 **three (3)** zones. (6 marks)

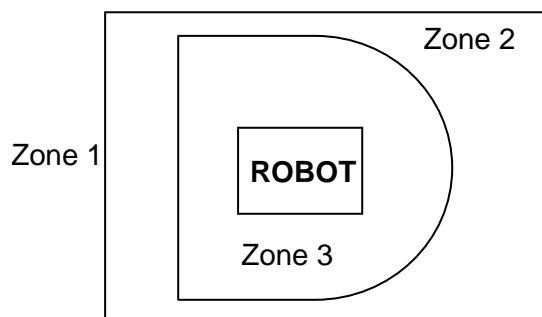


Figure 1: Safety zones

- (c) Give **one (1)** additional feature of second generation industrial robot with respect to the first generation. (3 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer TWO (2) questions only.

Please answers all in answer booklet provided.

Question 3

- (a) A vacuum gripper is used to lift a flat steel plate 6 x 50 x 70 cm. The gripper will utilize two suction cups, 12 cm in diameter each, and they will be located 36 cm apart for stability. A safety factor of 2 should be used to allow for acceleration of the plate. Determine the negative pressure required to lift the plates if the density of the steel is 7.85 g/cm^3

(15 marks)

- (b) Explain the end effector and its function.

(5 marks)

- (c) State the two major categories of end effectors?

(5 marks)

- (d) Describe the **five (5)** requirement of end effector's design.

(5 marks)

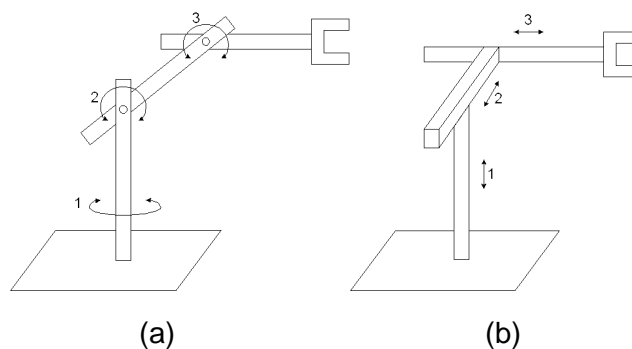
Question 4

- (a) Define **four (4)** principal geometries for robot manipulator.

(8 marks)

- (b) Determine the degree of freedom of each one it as shown in **Figure 2**.

(8 marks)



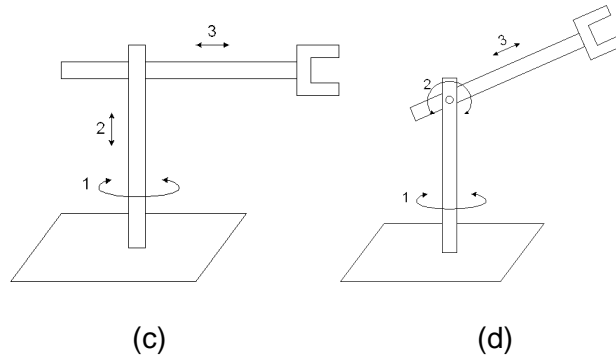


Figure 4: Robot manipulator

- (c) Give the definition of the following terms:
- (i). Work Envelope (2 marks)
 - (ii). Axis Numbering (2 marks)
 - (iii). Position Axes (2 marks)
- (d) List the advantage and disadvantage of all robot manipulator in **Figure 2**. (8 marks)

Question 5

- (a) Explain Robot Base World Coordinate, Joint Coordinate and TCP Coordinate System. State the differences of the Jogging operation in this coordinate system. (6 marks)
- (b) State the method of setting Tool Centre Point (TCP) Coordinate System. (2 marks)
- (c) State the method of setting Work Object Coordinate System. (2 marks)
- (d) Describe the instruction for sending signal output from robot and using input signal for continuing motion in robot ABB Teach Pendant Programming (4 marks)

- (e) Explain the important of path, speed, and zoning radial distance in teach pendant robot programming. Write ABB robot programming code to highlight the explanation

(6 marks)

- (f) Sketch the position and Orientation of Robot TCP Frame relative to robot base Frame of:-

- (i) Position: $X=500$, $Y=100$, $Z=750$. Orientation: Roll= 90, Pitch= 0, Yaw=90

(5marks)

- (ii) Position: $X=700$, $Y=100$, $Z=1000$. Orientation: Roll= 0, Pitch= 90, Yaw= 0

(5 marks)

END OF QUESTION