



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
SEPTEMBER 2014 SESSION

SUBJECT CODE : FAB11202
SUBJECT TITLE : ROBOTICS FUNDAMENTAL
LEVEL : BACHELOR
TIME / DURATION : 9.00 AM – 11.00 AM
(2 HOURS)
DATE : 11 JANUARY 2015

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.

THERE ARE 4 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)**INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.****Question 1**

- (a) Robots are considered to be a key element in automated manufacturing.
- (i) Define an industrial robot term refer to Robotic Industries Association's (RIA).
(4 marks)
- (ii) List **three (3)** laws of robotics introduced by Isaac Asimov contribution to the history of the robot.
(6 marks)
- (b) Robotics terminology consists of several elements. List **five (5)** of these elements and briefly explain these components and their purpose.
(10 marks)
- (c) Which configuration of manipulator that has the largest reach for the amount of floor space it occupies? Sketch and explain your answer.
(5 marks)

Question 2

- (a) End effectors are devices attached to wrist of a manipulator. List **five (5)** end effectors commonly found in industry.
(5 marks)
- (b) Illustrates **four (4)** relationships of accuracy and repeatability for industrial robot.
(4 marks)
- (c) Compare the **three (3)** types of drive power sources by preparing a table that illustrates the strengths and weakness of each
(6 marks)

SECTION B (Total: 60 marks)**INSTRUCTION: Answer only TWO (2) questions.****Please use the answer booklet provided.****Question 3**

- (a) Sensor is the most important element to be added when developing the industrial robot. List **two (2)** advantages of sensor and name **four (4)** types of sensors and its application.

(10 marks)

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

I. Position: $X=1000, Y=100, Z=750$. Orientation: Roll= 90, Pitch= 0, Yaw= 0

(5 marks)

II. Position: $X=1000, Y=100, Z=1000$. Orientation: Roll= 90, Pitch= 90, Yaw= 0

(5 marks)

III. Position: $X=1000, Y= -100, Z=1000$. Orientation: Roll= 90, Pitch= 90, Yaw= 90

(5 marks)

IV. Position: $X=1000, Y= -100, Z=750$. Orientation: Roll= - 90, Pitch= 90, Yaw= 90

(5 marks)

Question 4

- (a) Using the notation scheme for defining manipulator configurations in **Appendix 1**.

Sketch a robot manipulator for the following notation;

- (i) LRL
- (ii) RRL
- (iii) TRL
- (iv) LVL

(10 marks)

- (b) Determine the **six (6)** factors that must be considered when selecting a robot to perform an industrial task.

(6 marks)

- (c) List **four (4)** major configurations in industrial robot and give **one (1)** advantage and disadvantage of each configuration.

(10 marks)

- (d) Referring to the **Figure 1**, illustrates the work envelope of this robot.

(4 marks)

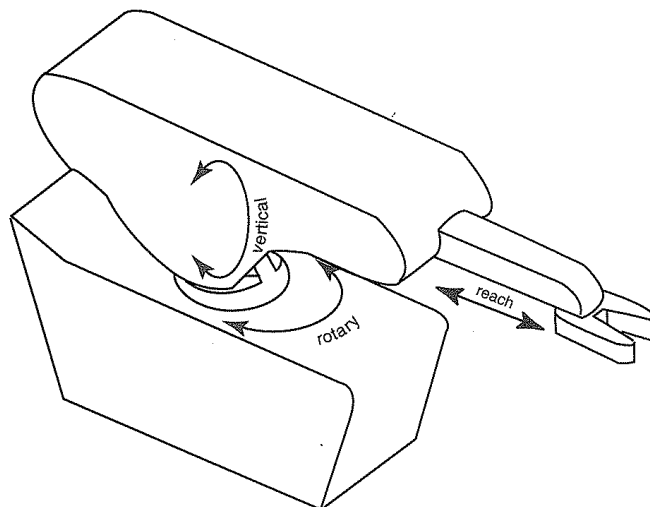


Figure 1: The Spherical Robot.

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. (8 Marks)
- (b) List down and elaborate the Task planning and Offline Programming using Robot Studio (To program robot TCP to move along path in robot studio simulation) (8 marks)
- (c) Explain the important of “Jump to target procedure” before *Move along path* in offline robot studio programming (4 marks)
- (d) A strategy for limiting access to the areas is illustrated in **Figure 2**. The work cell is divided into zones 1 to 3. Define these **three (3)** zones. (6 marks)

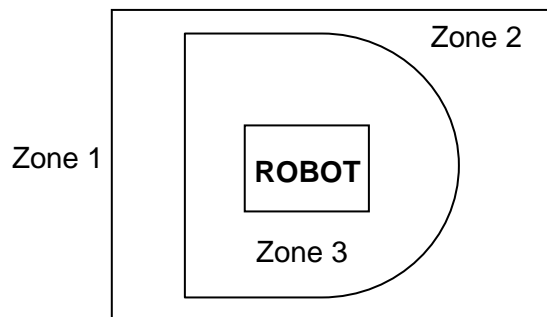
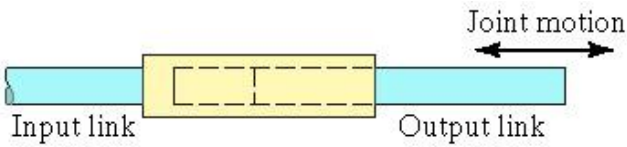
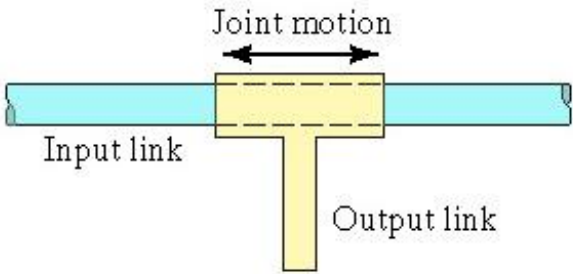
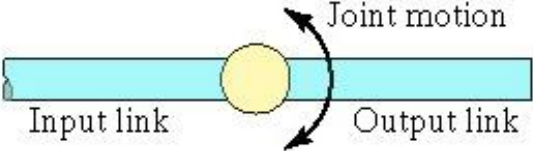
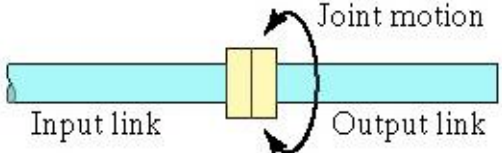
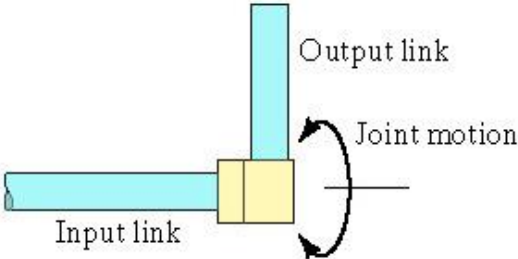


Figure 2: Safety zones

- (e) Describe online and offline programming. (4 marks)

END OF QUESTION

APPENDIX 1

| Notation | Diagram |
|---|---|
| <p>Linear joint (type L)</p> |  <p>Input link Output link</p> <p>Joint motion</p> |
| <p>Orthogonal joint (type O)</p> |  <p>Input link Output link</p> <p>Joint motion</p> |
| <p>Rotational joint (type R)</p> |  <p>Input link Output link</p> <p>Joint motion</p> |
| <p>Twisting joint (type T)</p> |  <p>Input link Output link</p> <p>Joint motion</p> |
| <p>Revolving joint (type V)</p> |  <p>Input link Output link</p> <p>Joint motion</p> |