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CONFIDENTIAL

SET B

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2011 SESSION

SUBJECT CODE	:	FAD 20302
SUBJECT TITLE	:	INTRODUCTION TO ROBOTICS
LEVEL	:	DIPLOMA
TIME / DURATION	:	2.00pm – 4.00pm (2 HOURS)
DATE	:	03 MAY 2011

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) questions only.
6. Answer all questions in English.

THERE ARE 5 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) Define the word "robota" which originates from a Czech word.

(2 marks)

(b) The term robotics has popularized through his novel and short story. Give a name of the writer.

(2 marks)

(c) Describe the **three** (3) laws of Robotics that was introduced by Asimov.

(6 marks)

(d) Discuss **two** (2) reasons why we use robots rather than using human in our industry.

(2 marks)

(e) Give **three** (3) benefits of industrial robotics application.

(3 marks)

(f) 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)

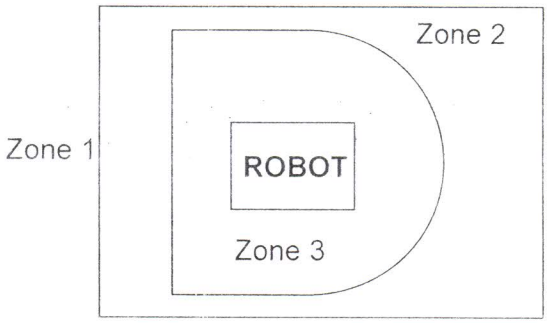

Figure 1: Safety zones

Question 2

(a) Define an industrial robot in International Standards Organization (ISO).

(4 marks)

(b) There are basically **three** (3) types of power sources for robots. Describe briefly each of them.

(6 marks)

(c) Explain the advantages and disadvantages between electrical and hydraulic drive.

(4 marks)

(d) State **five** (5) basic components of industrial robots.

(5 marks)

Question 3

(a) Define the following common terms in robotics:

(i). Degree of Freedom

(2 marks)

(ii). Manipulator

(2 marks)

(iii). End-effector

(2 marks)

(iv). Link

(2 marks)

(v). Joint

(2 marks)

(b) The purpose of the joint is to provide controlled relative movement between the input link and the output link. State **five** (5) types of joints for industrial robot design.

(5 marks)

(c) Name the wrist on orientation axes.

(3 marks)

(d) Define the part that mounted on the end of manipulator.

(2 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.
Please answers all in answer booklet provided.

Question 4

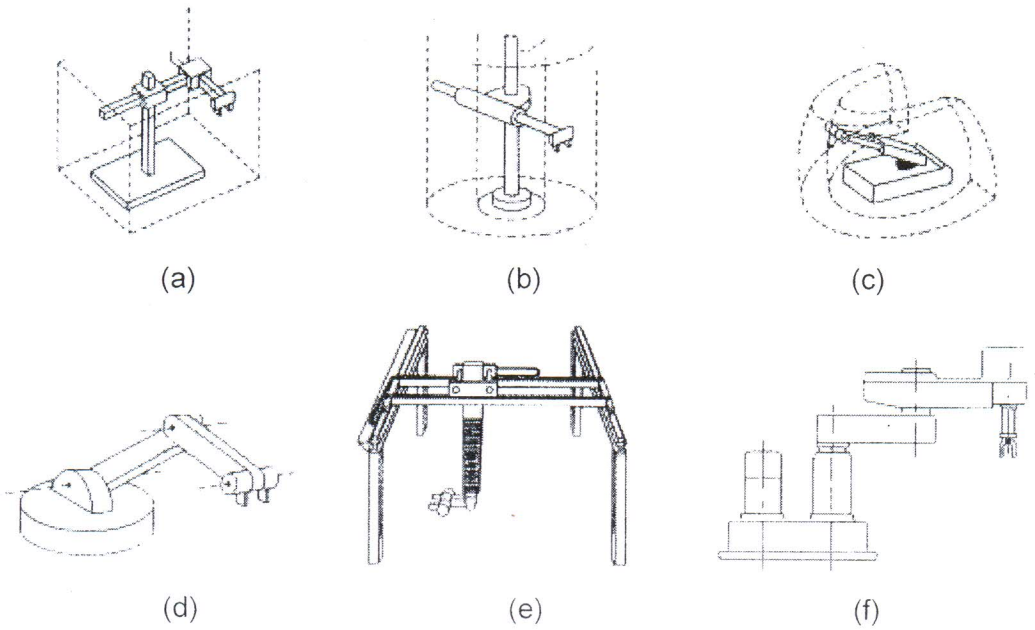

Figure 2: Robot arm configurations

(a) State each of robot arm configurations shown in **Figure 2**.

(6 marks)

(b) List an advantage and disadvantage of robot manipulator in **Figure 2**(b).

(2 marks)

(c) Give **two** (2) examples of industrial robot application for the robot arm configuration in **Figure 2**(a).

(2 marks)

(d) Based on **Figure 2**(a) and **Figure 2**(b), compare the work envelopes and explain which configuration gives the largest work envelope and justify your answer.

(10 marks)

Question 5

(a) Industrial robots can be programmed from a distance to perform their required and preprogrammed operations with different types of paths generated through different control techniques. The three different types of paths generated are Point-to-Point Path, Controlled Path, and Continuous Path. Discuss these three types of paths.

(6 marks)

(b) Give example applications that use these three types of paths on explained in (a).

(4 marks)

(c) Most articulated robots perform by storing a series of positions in memory, and moving to them at various times in their programming sequence. For example, a robot which is moving items from one place to another might have a simple 'pick and place' program similar to the following:

Define points P1–P5:

1. *Safely above workpiece (defined as P1)*
2. *10 cm Above bin A (defined as P2)*
3. *At position to take part from bin A (defined as P3)*
4. *10 cm Above bin B (defined as P4)*
5. *At position to take part from bin B. (defined as p5)*

Figure 3: Pick and place robot arm

Construct this program to follow the definition from **Figure 3** based on pick and place the object from Bin A to Bin B.

(10 marks)

Question 6

Based on Staubli-RX90 robot joints, shown in **Figure 4** answer the questions below

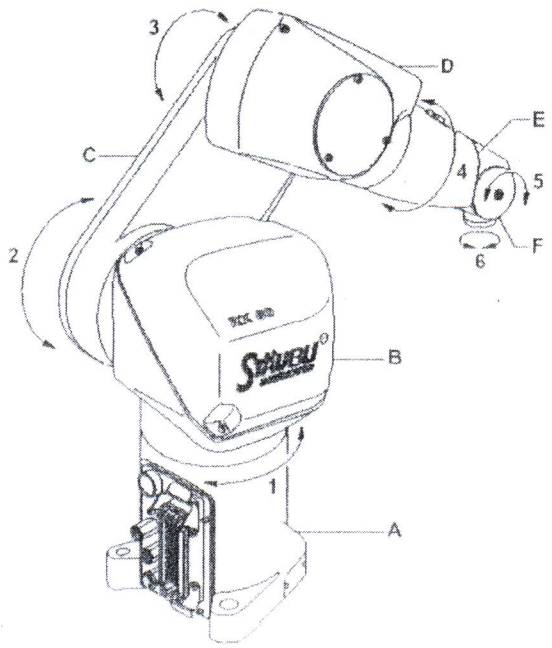

Figure 4: Elements of robot arm

(a) Determine the various elements of the robot arm (**A**, **B**, **C**, **D**, **E**, **and F**).

(6 marks)

(b) Referring to **Figure 4**; define the robot by its physical configuration.

(2 marks)

(c) State the number of degrees of freedom for Staubli-RX90.

(2 marks)

(d) Number of degrees of freedom, independently or in combination with others define the complete motion of the end-effector. List the types of joints for this robot arm.

(2 marks)

(e) Give **two** (2) example of industrial application for Staubli-RX90.

(4 marks)

(f) Based on your answer in (b), how does the SCARA arm geometry differ.

(4 marks)

END OF QUESTION