Document No : UniKL MFI_SD_AC41
Revision No: 02
Effective Date: 01 December 2008

CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FAD20302**
SUBJECT TITLE	:	**INTRODUCTION TO ROBOTICS**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**12.45 PM – 2.45 PM (2 HOURS)**
DATE	:	**8 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 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) The first reference to the word *robot* appears in a play opening in London in 1921. Karl Kapek introduces the word *robot* from Czech's word "*robota" in a play R.U.R.* Define *robot.*

(2 marks)

(b) List the **Three Laws of Robotics**.

(6 marks)

(c) Provide **two (2)** benefits of industrial robot applications either to the human life or industry.

(2 marks)

(d) Identify the **five (5)** major components of an industrial robot and describe the **function** of each component.

(10 marks)

Question 2

(a) An industrial robot will require a drive system for moving their arm, wrist, and body. A drive system is usually used to determine the capacity of a robot. For actuating the robot joints, there are three different types of drive systems available which are Electric Drive System, Hydraulic Drive System and Pneumatic Drive System. Provide **one (1)** advantage and **one (1)** disadvantage for each of those drive systems.

(6 marks)

(b) Define the robotic terms below:-

i. Payload
ii. Speed
iii. Work Envelope

(6 marks)

(c) The manipulator of an industrial robot is constructed of a series of links and joints as shown in **Figure 1**. Discuss the importancy of links and joints.

(3 marks)

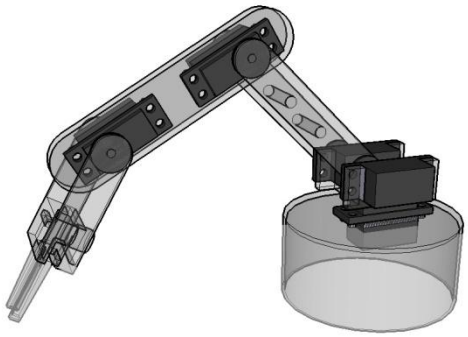


Figure 1: Robot Manipulator

(d) State the **five (5)** types of joints for industrial robot design.

(5 marks)

Question 3

(a) Robot manipulators are classified according to their arm geometry or kinematics structure. The majority of these manipulators fall into one of five type configurations. List the **five (5)** configurations of these manipulators.

(5 marks)

(b) Sketch the work envelope for each robot configuration answered in Question 3 (a).

(10 marks)

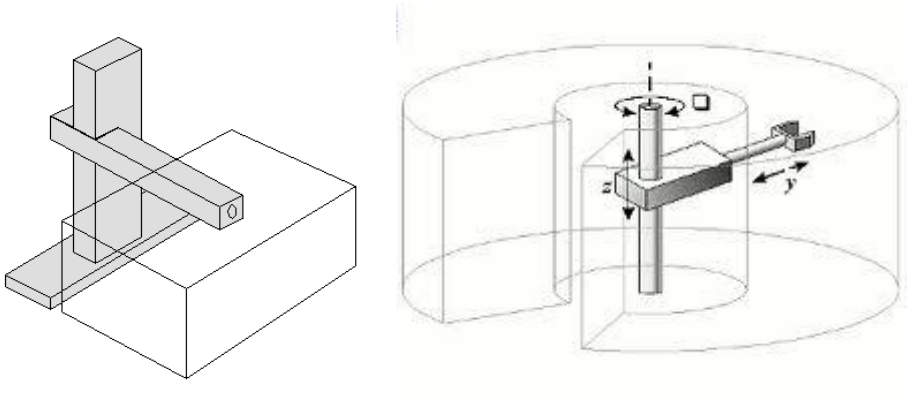
(c) Provide **two (2)** types of sensor that attach to the industrial robot commonly. Describe the function of sensor in Servo Robot Controller System.

(5 marks)

SECTION B (Total: 40 marks)

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

Question 4



(a) (b)

Figure 2: Robot Configuration and Work Envelope

Figure 2 shows two different robot configurations. Answer all the following questions.

(a) Identify the joint / axes type for each robot.

(4 marks)

(b) Determine their arm configuration.

(2 marks)

(c) Based on the answer from Question 4(b), compare each coordinate robot by the following:

i. Advantage and disadvantage

(8 marks)

ii. Number of DOF

(2 marks)

(d) Between those two robots, suggest on the suitable arm configuration to be applied in pick and place system. Justify your answer.

(2 marks)

(e) If robot (b) is applied for machine loading and unloading task in industry, suggest the suitable control system to be used.

(2 marks)

Question 5

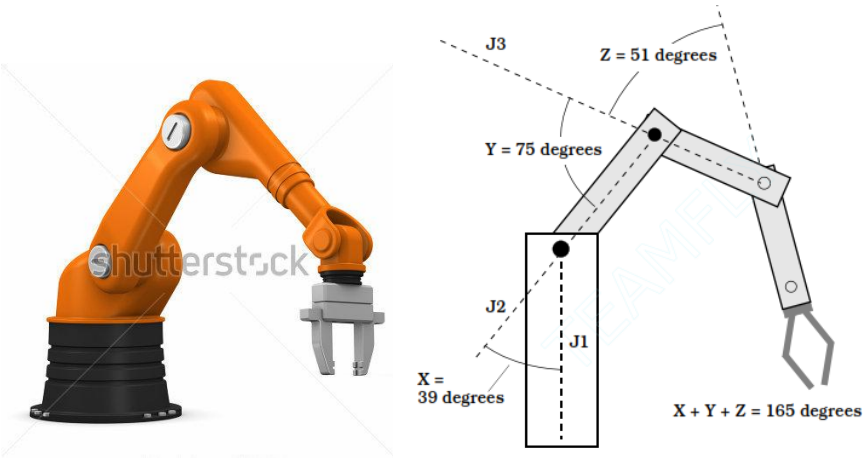


Figure 3: Industrial Robot Arm

Answer the following questions based on industrial robot arm in **Figure 3**.

(a) Sketch the work envelope for the robot.

(2 marks)

(b) Describe the joint type and robot configuration.

(3 marks)

(c) Determine the Degree of Freedom.

(1 mark)

(d) Identify whether it is an Open Kinematic Chain (OKC) or Closed Kinematic Chain (CKC). Explain the differences between both types.

(5 marks)

(e) State the type of end effector in the above robot. Describe the work mechanism of this end effector.

(3 marks)

(f) A steel frame weighing 2 kg is held in above end effector using friction against two opposing fingers. The coefficient of friction is 0.35. If the recommended safety factor (SF) = 2.5, calculate the necessary gripper force [N] in normal transportation.

(4 marks)

(g) Suggest a suitable gripper to handle a lightweight material such as a piece of paper.

(2 marks)

Question 6

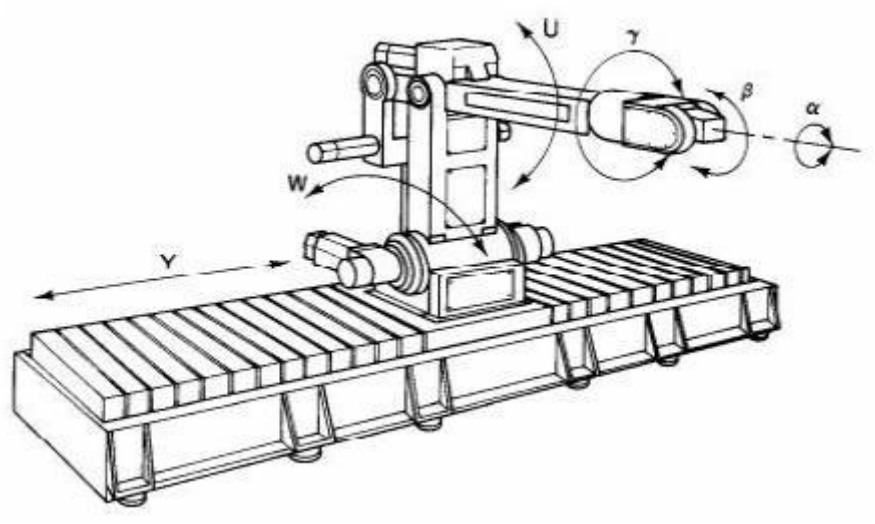


Figure 4: Elements of robot arm

Answer the following questions based on **Figure 4**.

(a) Sketch the work envelope for the robot.

(2 marks)

(b) Describe the joint type and robot configuration.

(3 marks)

(c) Determine the Degree of Freedom.

(1 mark).

(d) Compare the DOF and the motion axes of above robot to the human arm and wrist.

(4 marks)

(e) Suggest **one (1)** industrial application using above robot configuration.

(2 marks)

(f) Describe the differences between “Lead through Programming” and “Offline Programming” in terms of methods and their advantages.

(8 marks)

END OF QUESTION