UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

COURSE NAME	:	AUTOMATION SYSTEM AND ROBOTICS
COURSE CODE	:	DEK3223/ DAE32503
PROGRAMME	:	3 DEE/DET/DAE
EXAMINATION DATE	:	OCTOBER 2012
DURATION	:	2 1/2 HOURS
INSTRUCTIONS	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF TEN (10) PAGES

Q1 (a) Isaac Asimov states that the robot is used as a helper to humankind. Explain the Laws of Robotics (Zeroth Law & Three Laws of Robotics).

(8 marks)

(b) Discuss two reasons of using robots instead of human to perform a task.

(4 marks)

(c) Basic component of robot system are manipulator, end effectors, actuator, sensor, controller and teach pendant. Draw a simple robot system to show its basic components.

(8 marks)

Q2 (a) Define the term below:

(i) Payload
(ii) Reach

(4 marks)

(b) Repeatability is much more important than accuracy. Draw the simple diagram to show that the robot have:

(i) Poor repeatability & poor accuracy
(ii) Poor repeatability & good accuracy
(iii) Good repeatability & bad accuracy
(iv) Good repeatability & good accuracy

(8 marks)

(c) Referring to Figure Q2(c), suggest the safety procedure that should be follows by user to avoid all possible mishaps that might occur during the operation of the cell.

(8 marks)

Q3 (a) Define the word "degree of freedom" and draw a simple 3 DOF robot arm.

(4 marks)

(b) By referring to the Figure Q3(b)(i) and Figure Q3(b)(ii), differentiate the following characteristic in a table:

(i) Type of arm geometry.
(ii) Number of Degree of Freedom.
(iii) The work envelope
(iv) Two advantages of manipulator configuration.
(v) Two disadvantages of manipulator configuration.

(16 marks)

Q4 (a) Robot systems are usually classified as low-technology and high technology groups. Compare the low-technology and high-technology robots

(6 marks)

(b) The SCARA and spherical robots are several types of robot manipulator configuration. What are the differences between them? Give your answer based on the following features:

(i) Axes motion (with brief explanation).
(ii) Sketch the work envelope for swing view and elevation view.
(iii) The ability to reach around obstacle.

(6 marks)

(c) Identify and determine the following industrial robot in Figure Q4(c)(i), Figure Q4(c)(ii), Figure Q4(c)(iii) and Figure Q4(c)(iv) according to their characteristic such as:

(i) Arm geometry.
(ii) Number of degree of freedom (DOF).

(8 marks)

Q5 (a) Based on graftset in Figure Q5(a) illustrate the ladder diagram by using KEEP instruction.

(5 marks)

(b) In the Figure Q5(b), a tank is filled with two chemicals, which are then mixed together and drained. When the Start Button at input is pressed, the program will start Pump 1. After 5 seconds, the proper amount of Chemical 1 has been pumped, and the pump shuts off. Pumps 2 then runs for 3 seconds adding Chemical 2 to the tank. The program then starts the mixer motor and mixes the chemicals for 60 seconds. Then the drain valve is opened and Pump 3 is turned on for 8 seconds, emptying the tank. A manual Stop Button is provided at input process control.

(i) Identify the input and output assignment by using CJ1M address
(ii) Describe the production process flow by using motion diagram
(iii) Illustrate the PLC ladder diagram

(15 marks)

Q6 (a) Computer Numerically Controlled (CNC) can be defined as a form of programmable automation in which the process is controlled by number, letter and symbol. Discuss why CNC is important in industry?

(4 marks)

(b) A new system of manufacturing called Flexible Manufacturing System (FMS) is capable of producing a variety of parts. The basic FMS components are Workstations, Material Handling & Storage System, Computer Control System and Human Resources. Elaborate only two components stated above.

(6 marks)

(c) Write down the mnemonic code for the ladder diagram shown in Figure Q6(c).

(6 marks)

(d) Determine two advantages and disadvantages of implementing CNC machine in industry.

(4 marks)

Q7 (a) Automation manufacturing systems can be classified into three basic types that are Fixed Automation, Programmable Automation and Flexible Automation. Discuss the features of each automation types above according to:

(i) Definition
(ii) Configuration operation
(iii) Production
(iv) Changes

(12 marks)

(b) In the United States (U.S) most assembly lines and some entire plants are dedicated to a single model. If the model isn't selling, the line shuts down. U.S auto executives must plan only models that can sell at least 200,000 units (Bateman and Zeithaml,1993).

(i) Based on the above scenario, choose the most suitable type of automation manufacturing system used for the assembly lines. Explain why you choose that type.
(ii) Propose a new automation technology to overcome this problem.

(4 marks)

(c) Recommend the type of automation of the following products. You have to explain why you choose such answer. You can use an appropriate Figure to support your explanations.

(i) Colour pencil.
(ii) Examination table.

(4 marks)

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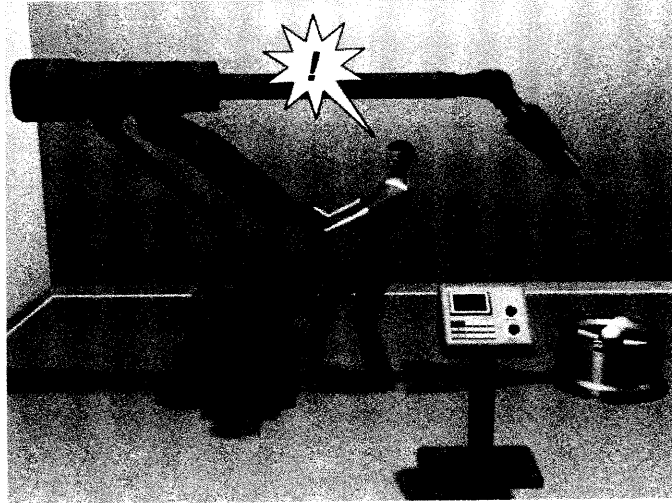
FIGURE Q2(c)
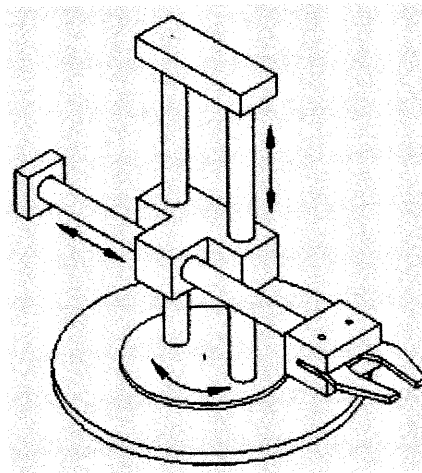
FIGURE Q3(b)(i)

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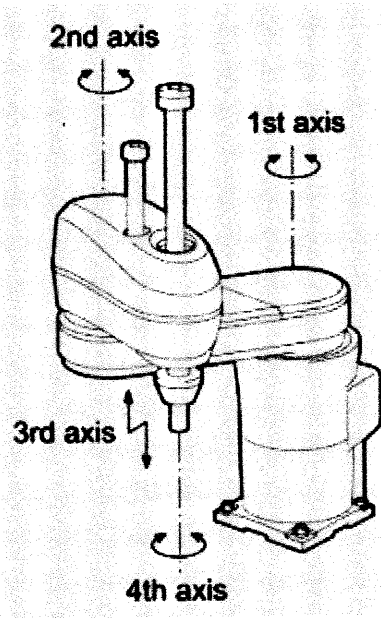
FIGURE Q3(b)(ii)
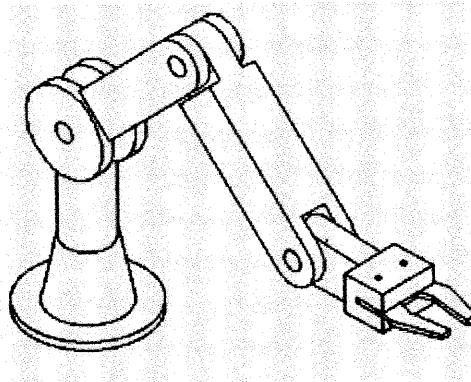
FIGURE Q4(c)(i)

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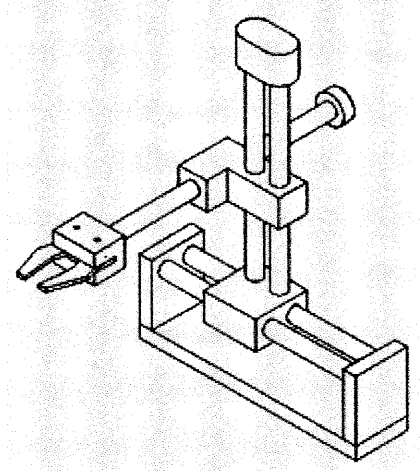
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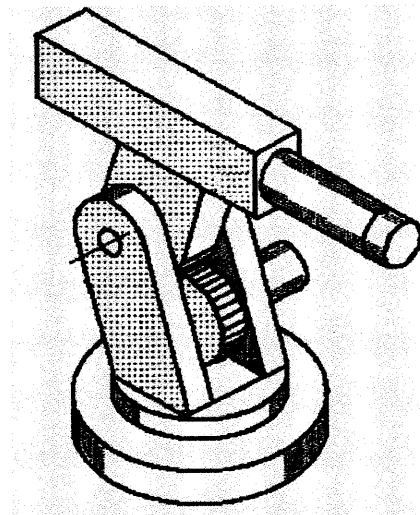
FIGURE Q4(c)(iii)

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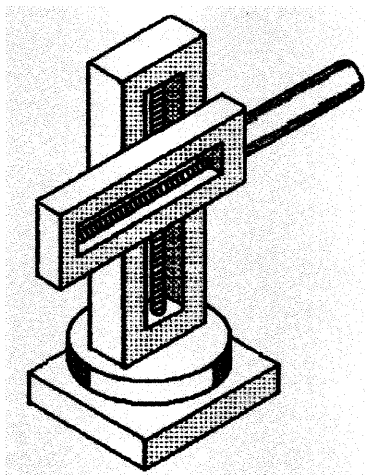
FIGURE Q4(c)(iv)
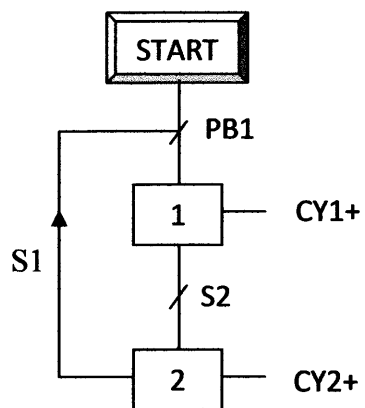
FIGURE Q5(a)

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FIGURE Q5(b)

FIGURE Q6(c)