Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	INDUSTRIAL AUTOMATION SYSTEM
COURSE CODE	:	BEJ34103 / BEH31103
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS **OPEN BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Identify the different manufacturing support systems in the provided boxes as illustrated in **Figure Q1(a)**.

(5 marks)

(b) List out **FIVE (5)** examples of Automated System Elements.

(5 marks)

(c) Identify the different parts of a proximity sensor and define the sensor as a transducer.

(5 marks)

(d) Explain the principle of operation of Retro-Reflective Sensor and fill in the blank boxes with the different elements of Retro-Reflective Sensor that is illustrated in the **Figure Q1(d)**.

(10 marks)

Q2 (a) Justify the working of the ultrasonic sensor with the following different elements.

(i) Roll diameter
(ii) Fluids
(iii) Solids (3 marks)

(b) Identify the differences between shielded and unshielded sensors in terms of sensing distance and mechanical properties.

(2 marks)

(c) Discuss the different components of reed sensor in the boxes associated with **Figure Q2(c)** and briefly state its important industrial function and application.

(9 marks)

(d) Define the importance of relays in industrial applications. Justify your answer based on the drawing of the circuit diagram **Figure Q2(d)**.

(6 marks)

(e) Distinguish the advantages and disadvantages of the Leadthrough Programming of the industrial robots.

(5 marks)

Q3 (a) Identify a circuit that is double pole double throw connected with a fan as a load. The fan should rotate in one direction only, even though the switch is moved in both positions. [**Hint:** electronic component can be installed in this circuit]

(5 marks)

(b) Identify the types of manipulator joints and the robot Arm-and-Body configurations

(6 marks)

(c) Construct the GRAFSET Diagram of the following narrative question. Refer to **Figure Q3(c)**.
A tank is filled with **TWO (2)** chemicals, which are then mixed together and drained. When the START Button at input is pressed, the program starts Pump 1. After **FIVE (5)** seconds, the proper amount of Chemical 1 has been pumped, and the pump shuts **OFF**. Pump 2 then runs for **THREE (3)** seconds adding Chemical 2 to

the tank. The program then starts the mixer motor and mixes the chemicals for **SIXTY** (**60**) seconds. Then the drain valve is opened and Pump 3 is turned **ON** for **EIGHT** (**8**) seconds, emptying the tank. A manual STOP Button is provided at input process control.

(8 marks)

(d) In case of retro-reflective sensor color and shape of object do not affect this sensor type but when the object is sheen or glossiness the object could pass by undetected. Investigate with diagram how polarized retro-reflective sensor could overcome this problem?

(6 marks)

Q4 (a) Define the advantages of Programmable Logic Controller (PLC) compared to Relay Control Panel.

(6 marks)

(b) Identify the correct input and output addresses by filling in the blanks provided below. Refer to **Figure Q4(b)** and **Table Q4(b)**.

(i) Identify any energized output in the ladder diagram of **FigureQ4(b)**. _____

(ii) Identify any contacts currently TRUE. _____

(iii) Identify any contacts currently FALSE. _____

(iv) With push-button (000.01) closed:

(a) Identify any input or output energized. _____ & _____

(b) Identify any input or output TRUE. _____

(c) Identify any input or output FALSE. _____

(7 marks)

(c) Construct a suitable ladder diagram structure that can satisfy the following constraints: **TWO** (**2**) outputs of **TWO** (2) motors (**M1**) and (**M2**), that controlled using **THREE** (**3**) inputs; those are (**START_1**), (**START_2**) and (**STOP**) momentary buttons. The process control would be described as follows:

(i) A motor (**M1**) is to start only if **START_1** (normally open momentary) button is pressed, it will stay running when **START_1** is released.

(ii) Only after motor (**M1**) has started may motor (**M2**) be start by pressing **START_2** (normally open momentary) button.

(iii) Once it is started, it will stay running even if motor (**M1**) shuts down.

(iv) Motor (**M1**) is to stop running after motor (**M2**) starts.

(v) If at any time the **STOP** (normally closed momentary) button is pressed, both motors (**M1**) and (**M2**) will stop.

(12 marks)

-END OF QUESTIONS –

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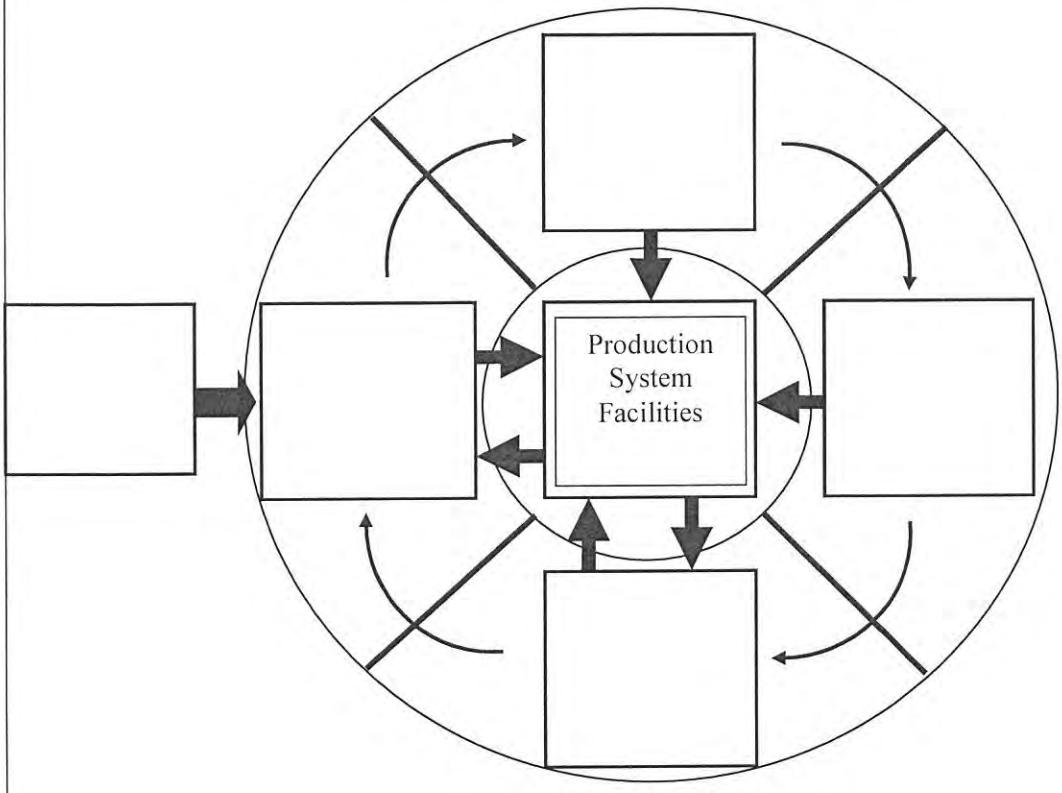

Figure Q1(a).

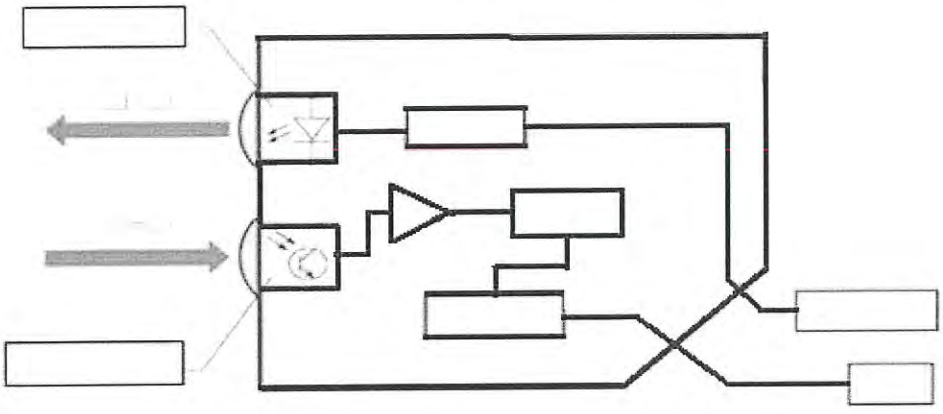

Figure Q1(d).

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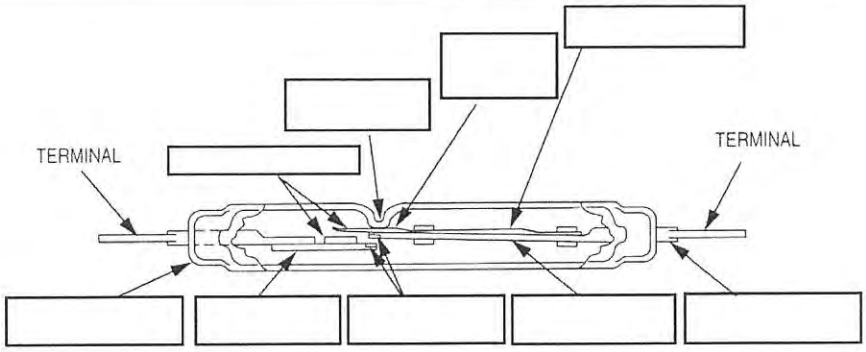

Figure Q2 (c)

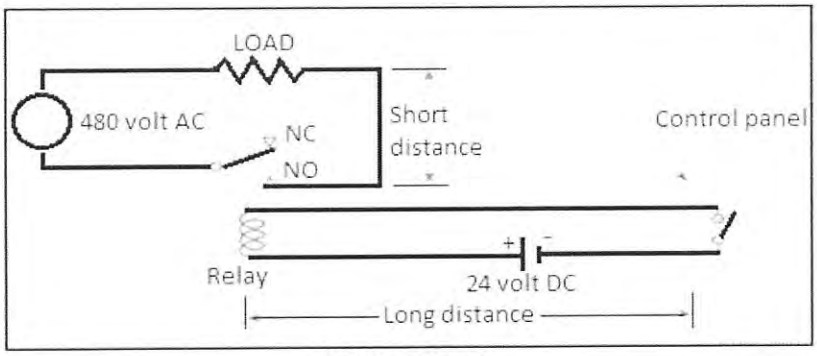

Figure Q2 (d)

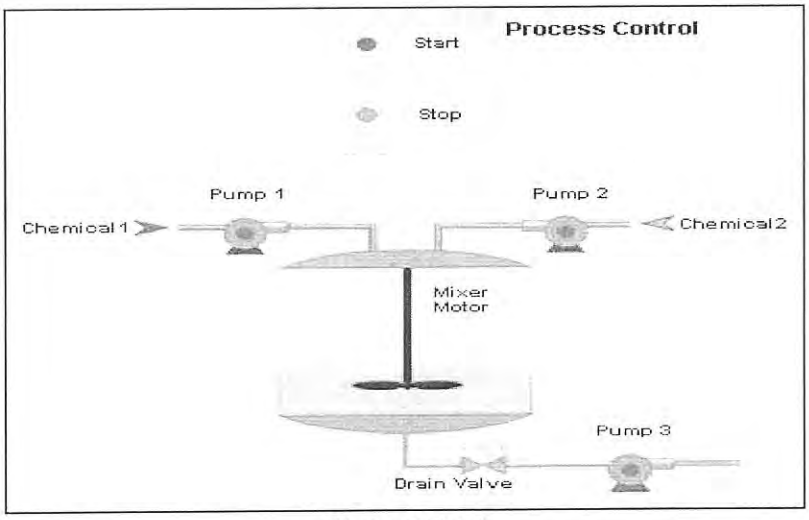

Figure Q3 (c)

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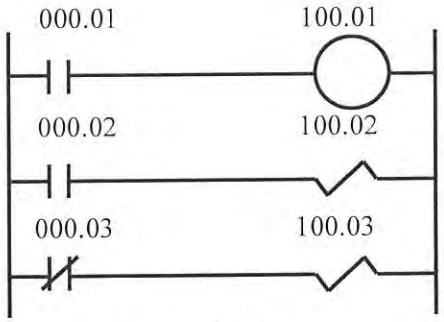

Figure Q4 (b)

Table Q4(b)

Input / Output Address	Symbol	Meaning of Symbol
000.01	1PB	Input Push-Button
000.02	1CR-1	Input Contact Relay 1
000.03	1CR-2	Input Contact Relay 2
100.01	1CR	Output Relay
100.02	1SOL	Output Solenoid 1
100.03	2SOL	Output Solenoid 2