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Universiti Tun Hussein Onn Malaysia


UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : INDUSTRIAL AUTOMATION
SYSTEM
COURSE CODE : BEH 31103
PROGRAMME CODE : BEJ
EXAMINATION DATE : DECEMBER 2019/ JANUARY 2020
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

- Q1** (a) Identify the different level of automation in the provided boxes as illustrated in **Figure Q1(a)**. (5 marks)
- (b) List out **THREE (3)** functions of the plant level of automation. (3 marks)
- (c) Explain a definition of a sensor as a transducer. Identify the different parts of a proximity sensor. (4 marks)
- (d) A layout of a C-type cargo elevator **Figure Q1(d)**; carrying goods from ground floor to 1st floor. At each floor, a worker could press a push-button to call the elevator. The entrance of the elevator is gated, and the elevator would not travel if the gate is not properly closed. The elevator is designed to speed up once leaving the floor but slowly deaccelerated whenever reaching another end and stop at the stopping position at low speed. At each floor, the elevator is immobilized if the elevator has over-travelled the stopping position. an alarm would be triggered if over-travelled.
- (i) Propose the location of appropriate sensors and push-buttons; based on the description of the cargo elevator.
(Clearly provide your answer on the **Figure Q1(d)(i)** with indication to the layout and mark the locations of the sensors and push-buttons). (7 marks)
- (ii) Justify the reasons behind the selected sensors and its locations proposed in **Q1(d)(i)**. (4 marks)
- (iii) Identify the difference of wiring connection of the common terminal with the battery; when the sensor became sourcing or sinking form of connection. **Figure Q1(d)(iii)**. (2 marks)
- Q2** (a) Identify the different elements of Retro-Reflective Sensor that is illustrated in the **Figure Q2(a)**. Explain the principle of operation of Retro-Reflective Sensor. (10 marks)
- (b) Justify the proper working of the Ultrasonic Sensor with the following different elements.
- (i) Roll diameter
- (ii) Fluids
- (iii) Solids
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- (c) Define what is a spot sensor. Justify the spot sensor SETUP in order to work in an efficient manner. (3 marks)

- (d) Discuss the different components of reed sensor in the boxes associated with **Figure Q2(d)** and briefly state its important industrial function and application. (9 marks)

- Q3** (a) Define the importance of relays in industrial applications. Justify your answer based on the drawing of the circuit diagram **Figure Q3(a)**. (6 marks)

- (b) Identify a circuit double pole double throw with a fan as a load, provided that the fan will rotate in one direction only even though the switch is moved in both positions. [**Hint:** electronic component can be installed in this circuit] (6 marks)

- (c) Sketch with the help of a diagram; the configuration of Jointed-Arm Robot. (2 marks)

- (d) Distinguish the advantages and disadvantages of the Leadthrough Programming of the industrial robots. (3 marks)

- (e) Construct the GRAFSET Diagram of the following narrative question. Refer to **Figure Q3(e)**.
 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)

- Q4** (a) Define the advantages of Programmable Logic Controller (PLC) compared to Relay Control Panel. (6 marks)

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

- (i) Categorize any energized output in the ladder diagram of FigureQ4(a).
 - (ii) Categorize any contacts currently TRUE. _____
 - (iii) Categorize any contacts currently FALSE. _____
 - (iv) With push-button (000.01) closed:
 - (a) Categorize any input or output energized. _____ & _____
 - (b) Categorize any input or output TRUE. _____
 - (c) Categorize any input or output FALSE. _____
- (7 marks)

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(c) Justify a ladder diagram for the following industrial process control of **TWO (2)** outputs of two 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 as 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 (**M1**) has started may (**M2**) be start by pressing **START_2** (Normally Open momentary) button.
- (iii) Once it is started, it will stay running even if (**M1**) shuts down.
- (iv) (**M1**) is to stop running after (**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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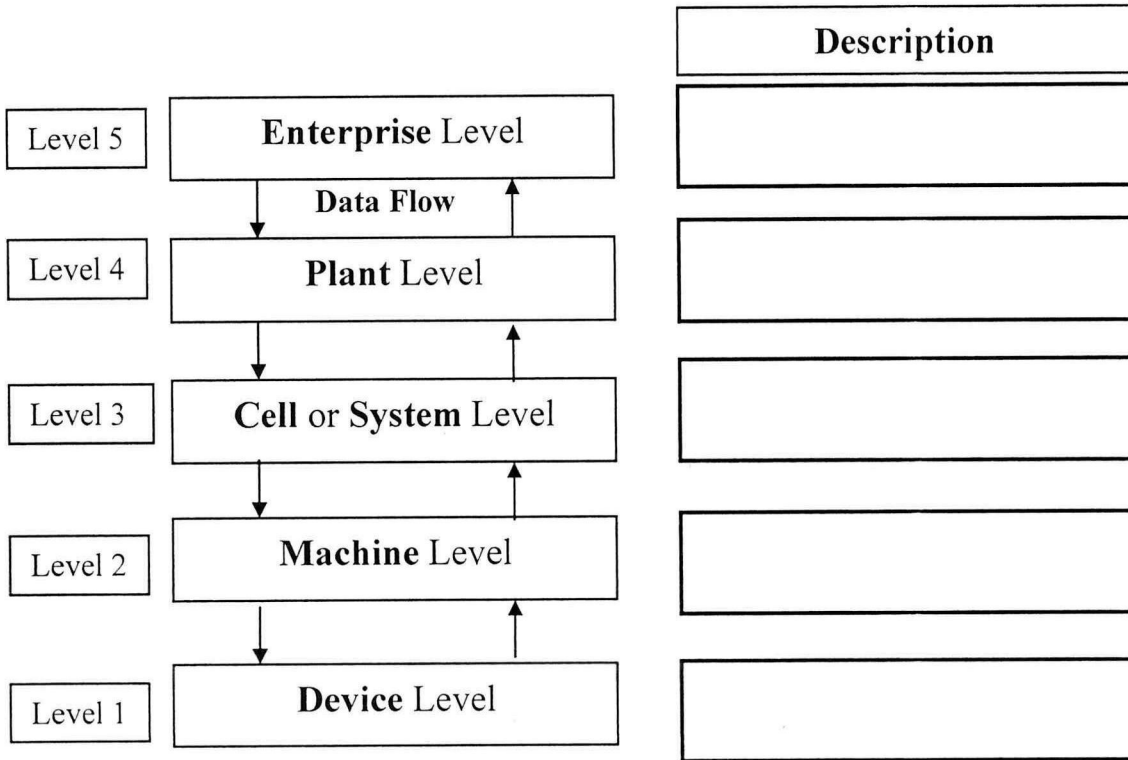


Figure Q1(a).

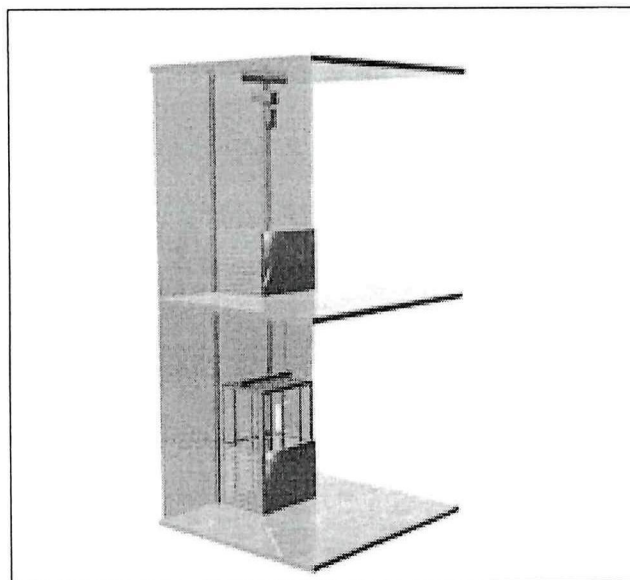


Figure Q1(d)

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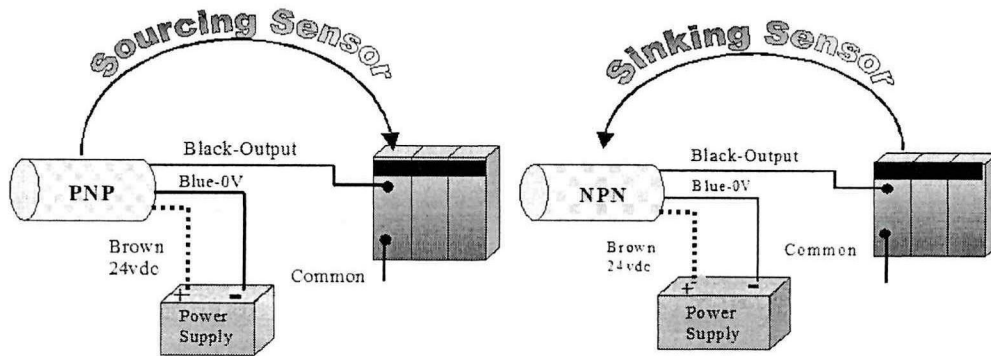


Figure Q1(d)(iii)

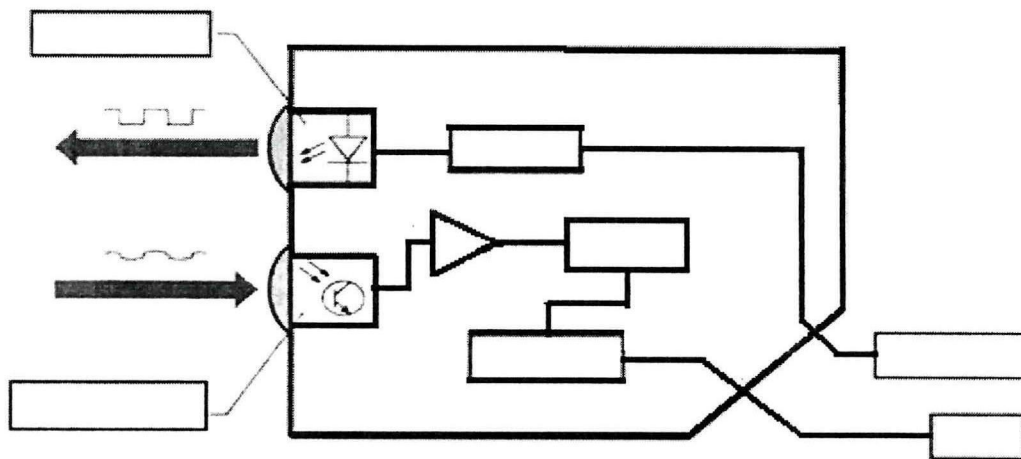


Figure Q2 (a)

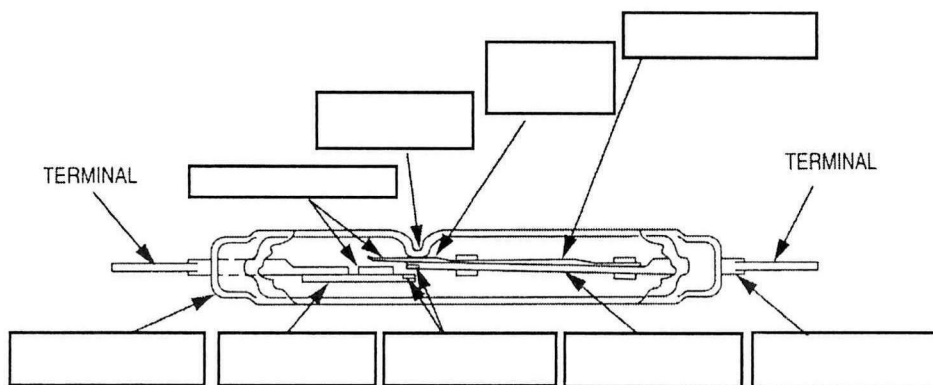


Figure Q2 (d)

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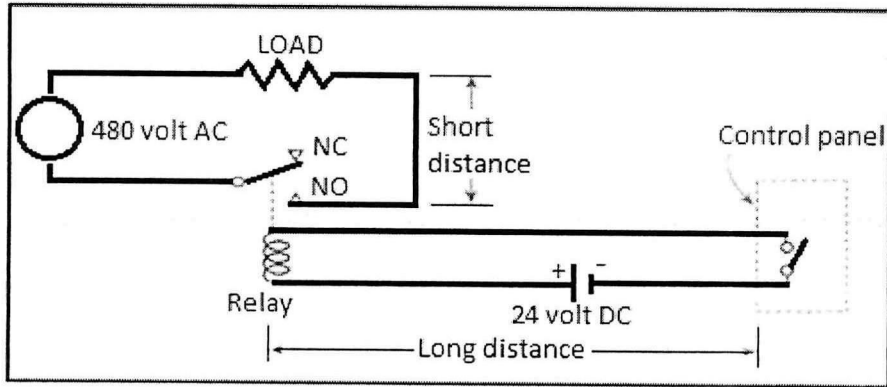


Figure Q3 (a)

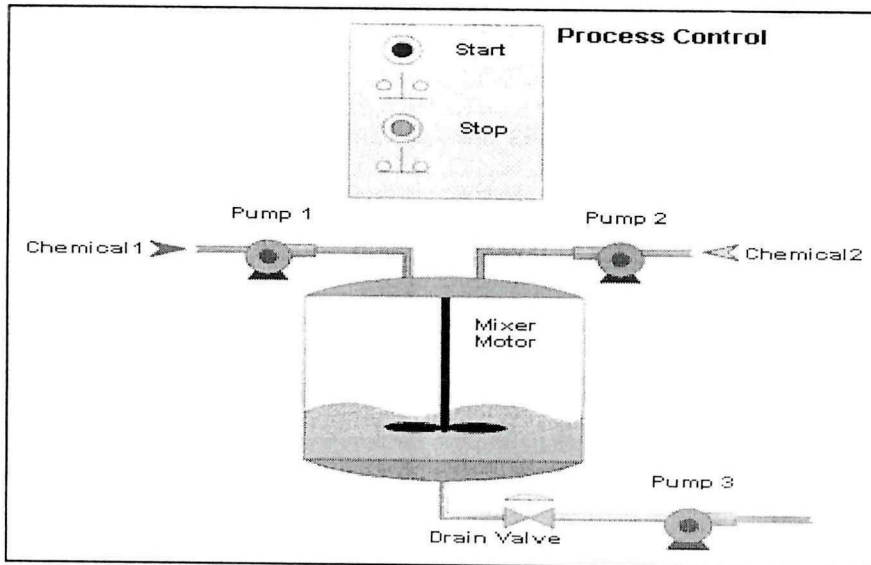


Figure Q3 (e)

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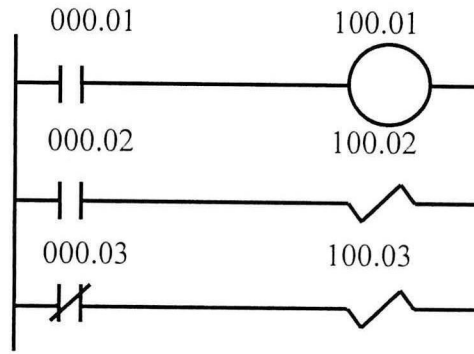


Figure Q4 (b)

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

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