

**UNIVERSITY COLLEGE TATI(UCTATI)**

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BMT 4043
COURSE	: AUTOMATION ENGINEERING TECHNOLOGY
SEMESTER/SESSION	: 2- 2022/2023
DURATION	: 3 HOURS

Instructions:

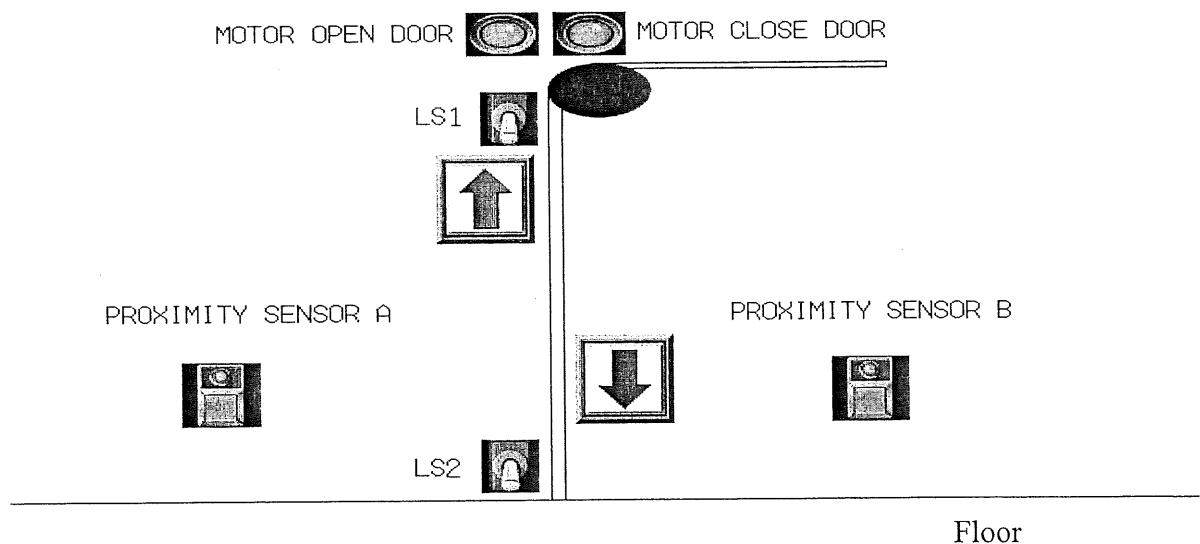
1. This booklet contains 4 questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 9 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

- a) Describe the function of **counter program** in PLC. (5 marks)
- b) Describe the function of **latching program** in PLC. (5 marks)
- c) Illustrate an example program using a **program counter** in a PLC. (6 marks)
- d) Refer to Figure 1. An automatic door garage is equipped with proximity sensor A and proximity sensor B. Proximity sensor A is located outside of the garage that detects the approaching vehicle and after the period of 5 seconds, the motor turns on (in clockwise direction) to open the garage. The motor turns off when it has reached the top part of garage, this is trigger using limit switch LS1. Proximity sensor B is located inside the garage and it detects the end body of the vehicle has safely park inside the garage. After the period of 5 seconds, the motor turns on (in anti-clockwise direction) to close the garage. The motor turns off when it has reached the bottom part of the garage detected by limit switch LS2.



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- i) Draw a circuit diagram to the PLC terminal/port according to table 1.

Table 1

No	Components	Address to PLC terminals/ ports
1	Proximity sensor A	0.00
2	Limit switch LS1	0.01
3	Limit switch LS2	0.02
4	Motor clockwise direction	100.00
5	Motor anticlockwise direction	100.01

(5 marks)

- ii) Develop the required ladder diagram by using the edge detection instruction to operate the door garage. (10 marks)

QUESTION 2

- a) Describe the function of **Jump Instruction** in PLC, illustrate it to explain the description.
(4 marks)
- b) Describe the **Interlock Instruction function**, a program diagram can be used to explain an example of its function.
(4 marks)
- c) Figure 2 shows the piston rod of a double acting cylinder 1 is to extend, when three of normally open pushbuttons (**PB1 AND PB2 AND PB3**) are actuated and will only retract when the fully extend position of a double acting cylinder is reached, which detected by a normally open Roller Limit switch (RLSW1) **AND**, after **20 seconds** extension of fully extension of cylinder.

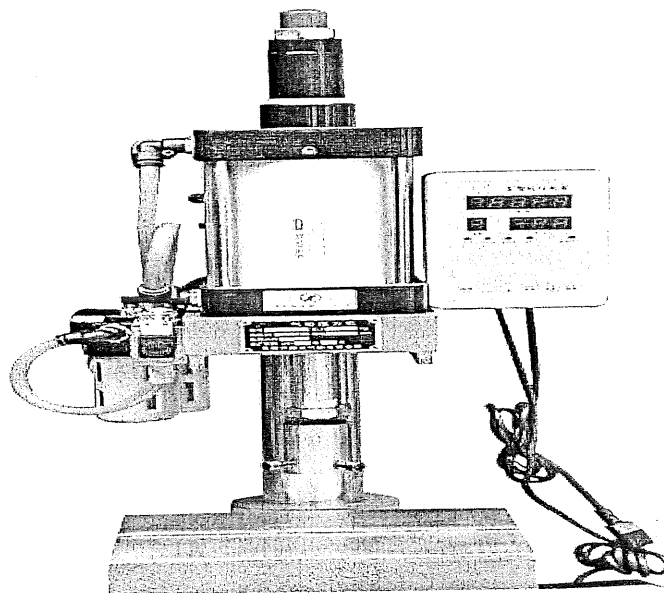


Figure 2

- i) Draw a circuit diagram to the PLC terminal/port according to table 2.

Table 2

No	Components	Address to PLC terminals/ ports
1	Push button 1 (PB1)	0.00
2	Push button 2 (PB2)	0.01
3	Push button 3 (PB3)	0.02
4	Roller limit switch 1 (RLSW 1)	0.03
5	Solenoid 1 (Y1)	100.00
6	Solenoid 2 (Y2)	100.01

(5marks)

- ii) Develop the required PLC program by using **SET /RESET** method to operate machine.

(10 marks)

QUESTION 3

- a) Describe the meaning of **PID module** in PLC. (5 marks)
- b) Describe the **Shift Register** as it is used in PLC. (5 marks)
- c) Figure 3 shows an automatic filling and labeling machine, starting with the process of detecting product defects (bottles) by a sensor 1, where if this sensor 1 detects a defect in a bottle, then the process of filling the product into the bottle and placing the bottle cap, to the bottle this defect will not happen, it only goes through as a reject product.

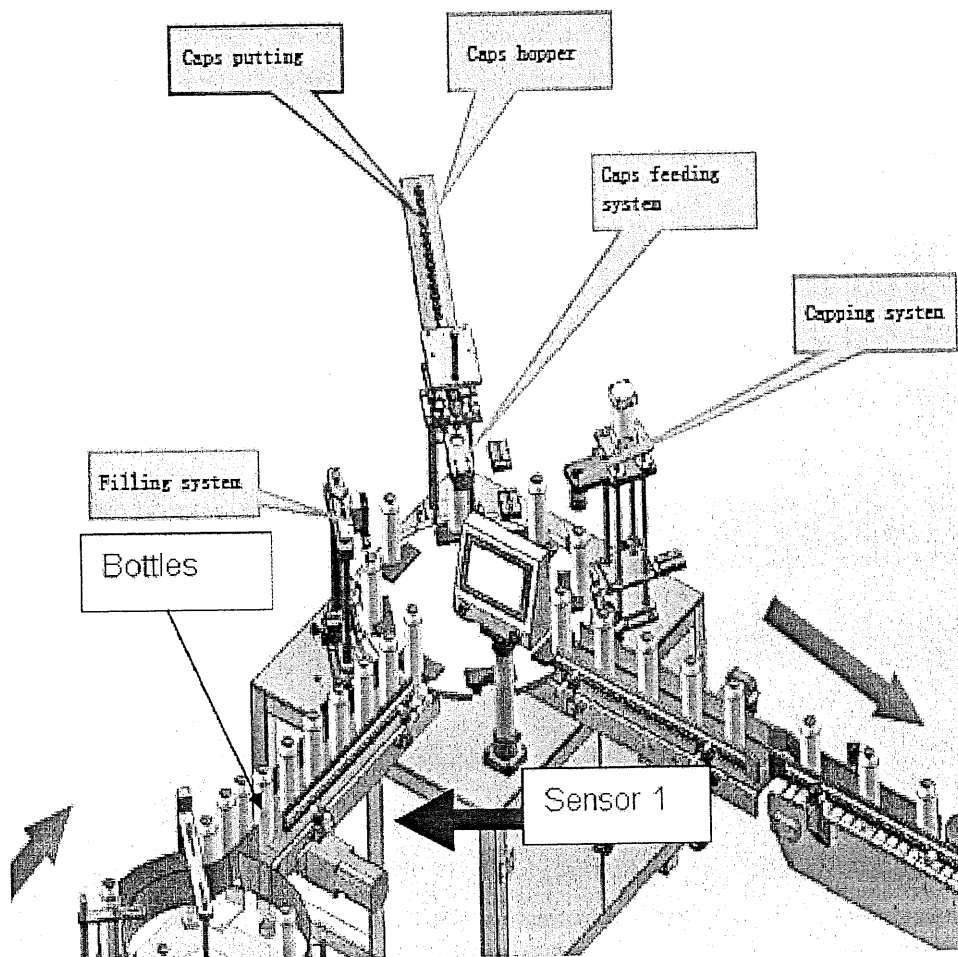


Figure 3

- i) Draw a circuit diagram to the PLC terminal/port according to table 3.

Table 3

No	Components	Address to PLC terminals/ ports
1	START PB (PB 1)	0.00
2	STOP PB (PB2)	0.01
3	EMERGENCY PB (PB 3)	0.02
4	SENSOR 1 (SEN 1)	0.03
5	Filing system -solenoid valve 1 (SV 1)	100.00
6	Caps feeding system–solenoid valve 2 (SV 2)	100.01
7	Capping system – DC motor 1 (M1)	100.2

(5 marks)

- ii) Develop the required **SHIFT REGISTER** program to operate the above problem.

(10 marks)

QUESTION 4

- a) i) List 3 functions of Analog to Digital Converter (ADC). (3 marks)
- ii) Explain how **Digitization process** occurs, to change continuous signal to binary value stored in PLC register. (6 marks)
- b) An input module, which is connected to a temperature transducer, has an ADC with a 12 bit resolution. When the temperature transducer receives a valid signal from the process (100 to 600°C), it provides via a transmitter, a +1 to +5 VDC signal compatible with the analogue input module. Please refer to figure 4.

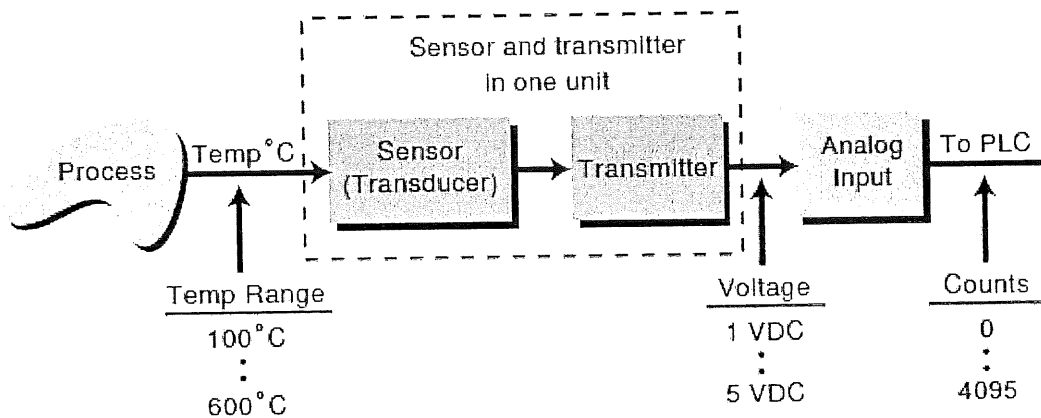


Figure 4

- i) Calculate the equivalent voltage change for each count change (the voltage change per degree Celsius change) and the equivalent number of counts per degree Celsius, assuming that the input module transforms the data into a linear 0 to 4095 counts. (6 marks)
- ii) Find the same values for a module with a 10 bit resolution. (6 marks)

-----End of question-----