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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023**

COURSE NAME	:	CONTROL SYSTEM
COURSE CODE	:	BBV 30503
PROGRAMME CODE	:	BBE
EXAMINATION DATE	:	JULY /AUGUST 2023
DURATION	:	3 HOURS
INSTRUCTIONS		<ol style="list-style-type: none">1. ANSWER ALL QUESTIONS2. THIS FINAL EXAMINATION IS CONDUCTED VIA CLOSED BOOK3. STUDENTS ARE PROHIBITED TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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TERBUKA

- Q1**
- (a) Outline the differences between a Programmable Logic Controller (PLC) and a Peripheral Interface Controller(PIC). (4 marks)
 - (b) Provide a diagram that shows the internal architecture of a PLC. (5 marks)
 - (c) Describe the basic steps of operation of a PLC after it is turned on. (4 marks)
 - (d) State the characteristics of the relay, transistor and TRIAC types of PLC output channels. (6 marks)
 - (e) Given a clear plastic bottle, briefly explain three(3) types of optical sensors and decide which sensor could be used to detect it. (6 marks)
- Q2**
- (a) In order to set up a functional control system, a set of pneumatic equipment is required. Draw the equipment set symbols as listed below:
 - (i) Shuttle valve. (1 marks)
 - (ii) One-way flow control valve. (1 marks)
 - (iii) Single acting cylinder. (1 marks)
 - (iv) 3/2-way valve with the pushbutton, normally closed. (2 marks)
 - (v) 5/2-way valve, pneumatically actuated at both ends. (2 marks)

- (b) Prototypes of aluminium housings need to be stamped with ID codes as shown in **Figure Q2(b)**. The housings are inserted into the stamping machine by hand. A pneumatic cylinder is used to stamp the codes and requires the flow of the air restricted at the inlet, and use the spring to determine the speed of retraction. This stamping cylinder can be operated and controlled manually to actuate the forward and return strokes in two different circuits; either a pushbutton actuator or a foot lever actuator. The actuator is held down until the stamping procedure is complete.

Develop a control system that can be used to carry out this process using most of the equipment listed in **Q2(a)**.

(10 marks)

- (c) A proximity sensor is a device that can detect or sense the approach or presence of nearby objects and for this it does not need physical contact. Describe the four(4) types of proximity sensor.

(8 marks)

- Q3** (a) State five(5) programming languages used in PLC.

(5 marks)

- (b) Sketch a ladder diagram for each statement below:

- (i) Two switches are normally open and both have to be closed for a motor to operate.

(2 marks)

- (ii) A lamp is to be switched on if there is an input from sensor A or sensor B.

(2 marks)

- (iii) A solenoid valve is to be activated if sensor A gives an input.

(2 marks)

- (iv) Either of two, normally open, switches have to be closed for a coil to be energised and operate an actuator.

(2 marks)

- (v) A motor is switched on by pressing a spring-return push button start switch, and the motor remains on until another spring-return push button stop switch is pressed.

(2 marks)

- (c) Sketch a ladder diagram to operate an automatic drilling machine based on **Figure Q3(a)**. The drill motor and the pump for the air pressure for the pneumatic valves have to be started. The workpiece has to be clamped. The drill has then to be lowered and drilling started to the required depth. Then the drill has to be retracted and the workpiece unclamped

(10 marks)

- Q4** (a) The Sequential Function Chart (SFC) language is a powerful graphical technique for describing the sequential behavior of a program. With the help of diagrams, explain three(3) types of SFC language. (6 marks)
- (b) A PLC has three inputs, and one output. Inputs X1 and X2 are momentary contact normally open push button switches. X3 is a normally closed push button switch. Output Y1 is a coil for the control circuit of a meat grinder motor. For safety, the PLC is to be programmed so that a person must be pressing both X1 and X2 (one with each hand) in order to start the grinder. The grinder is to remain running for 30 seconds once both buttons are pressed and released. The grinder is to stop if X3 is momentarily pressed.
- (i) Construct the truth table (4 marks)
- (ii) Simplify the equation from the truth table using Boolean algebra (4 marks)
- (iii) Sketch the PLC ladder diagram. (6 marks)
- (iv) Revise the ladder diagram using the function block diagram (5 marks)

-END OF QUESTIONS -

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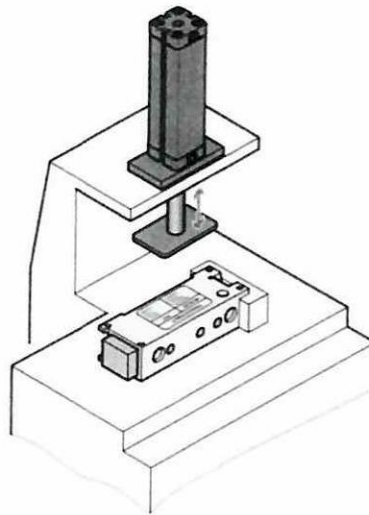


Figure Q2(b)

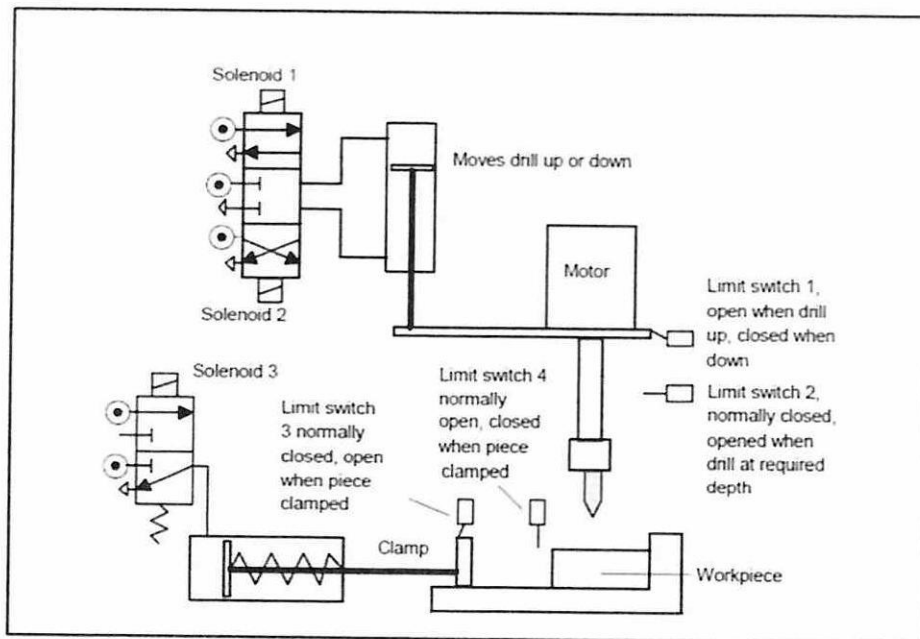


Figure Q3(a)