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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024**

COURSE NAME : CONTROL SYSTEM
COURSE CODE : BBV 30503
PROGRAMME CODE : BBE
EXAMINATION DATE : JULY 2024
DURATION : 3 HOURS
INSTRUCTION : 1. ANSWER ALL QUESTIONS.
2. THIS FINAL EXAMINATION IS CONDUCTED VIA
 Open book
 Closed book
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

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Q1. (a) List **three (3)** types of PLC languages in accordance with IEC61131-3 (3 marks)

(b) **Figure Q1.1** shows a ladder diagram for simple logic control of two normally open push buttons (S1 and S2) and a light indicator (H1).

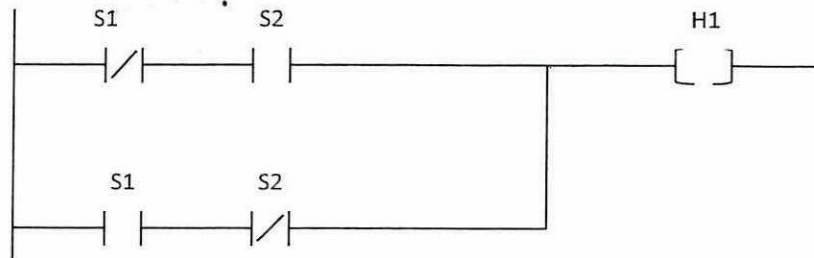


Figure Q1.1

Explain all possible signal assignments of push buttons for the program in which the light indicator will be switched on and any possible signal assignments of push buttons for the program in which the light indicator will be switched off.

(6 marks)

(c) **Figure Q1.2** shows a ladder diagram for a control system for alarm events in case of any error or fault triggered in an industrial machinery system.

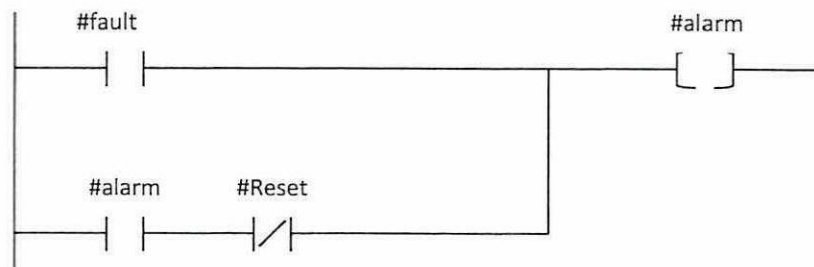


Figure Q1.2

Explain the operation of the ladder diagram based on **Figure Q1.2**

(6 marks)

(d) Based on the previous question, **Q1(c)**, develop an alternative solution of the ladder diagram that provides the same operation result.

(4 marks)

- (e) **Figure Q1.3** illustrates the control system of a bulk material mixing system consisting of a normally open push button (S1) and a normally open selector detent switch (S2). **Figure Q1.4** shows the electro-pneumatic circuit diagram for the system. Once the appropriate silo has been selected using the selector detent switch (S2), pressing the push button (S1) opens the silo accordingly. Both silos use single solenoid valves to control double-acting cylinders respectively. The cylinders are extended in the initial position. Design the control system using a ladder diagram to carry out this process. (6 marks)

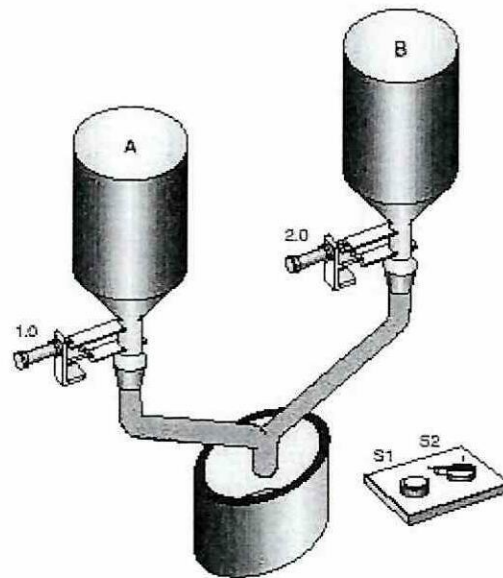


Figure Q1.3

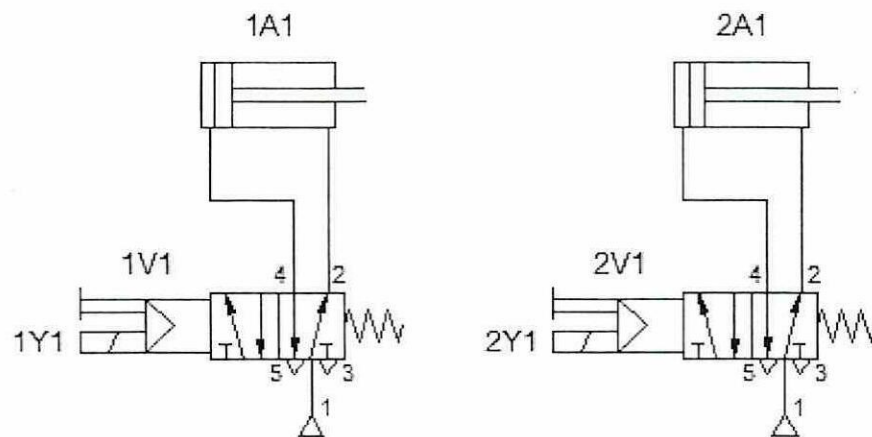


Figure Q1.4

Q2. (a) List **two(2)** types of signal edges.

(2 marks)

(b) Explain the signal edges operation in PLC programming in accordance with IEC61131-3.

(4 marks)

(c) Explain the Time Pulse (TP) Timer operation in PLC programming in accordance with IEC61131-3.

(4 marks)

(d) Sketch the timing diagram for the Time Pulse (TP) Timer.

(5 marks)

(e) **Figure Q2.1** shows the electrical circuit diagram of manual control (without the use of PLC) of the stamping process machine. Develop a control system using a ladder diagram to provide the same operation result by including a suitable function block, either RS block or SR block by complies with the IEC61131-3 standard.

(10 marks)

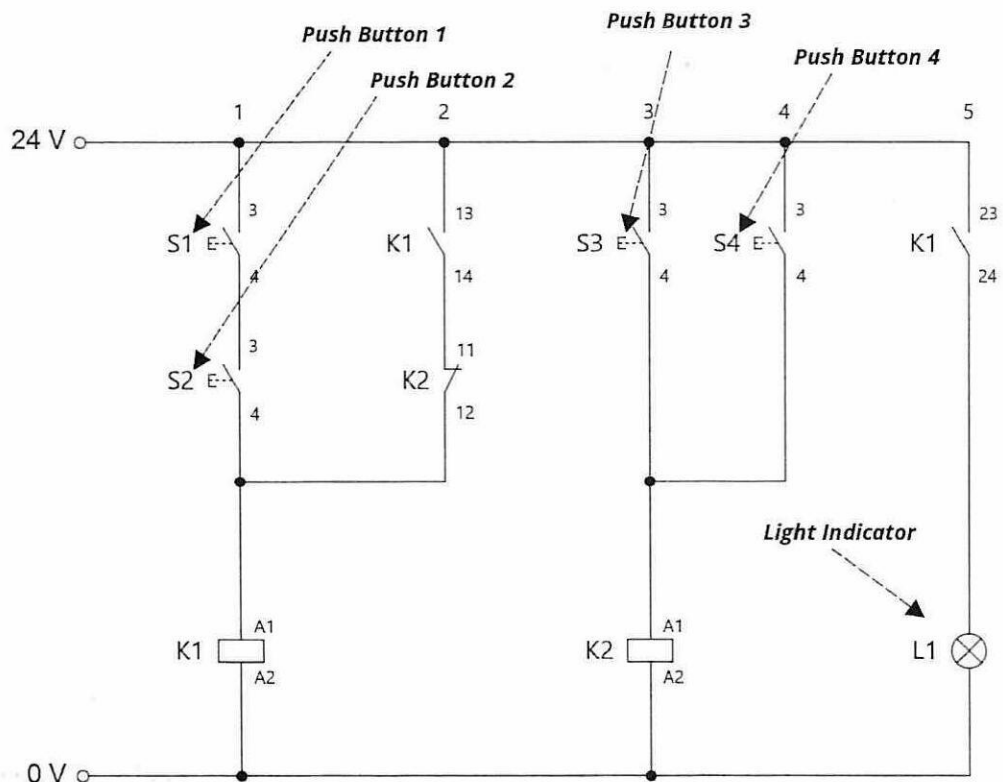


Figure Q2.1

- Q3.** (a) List **three (3)** characteristics of directional control valves. (3 marks)
- (b) Explain the function of the air filter in the air service unit. (2 marks)
- (c) Explain the function of the air lubricator in the air service unit. (2 marks)
- (d) **Figure Q3.1** illustrates a process of clamping a workpiece which is to be controlled by either of two push buttons. A third push button is to release the clamp. Additional criteria of the process are the clamp can be released only when the clamping cylinder is fully advanced, the clamping speed is to be slow and adjustable, and the unclamping speed is to be maximized as fast as possible. Develop an electro-pneumatic control system to carry out this process. Use a single solenoid directional control valve to control the double-acting cylinder, which acts as a clamping cylinder.

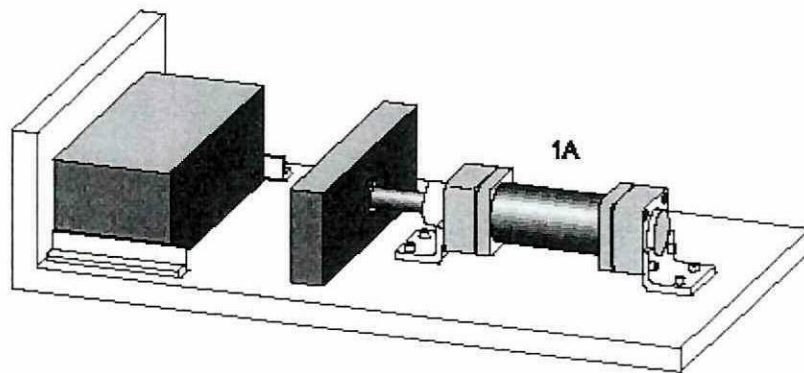


Figure Q3.1

- (i) Design a pneumatic circuit diagram to meet the control system requirement. (9 marks)
- (ii) Design an electrical relay control circuit diagram to meet the control system requirement. (9 marks)

- Q4.** (a) List **three (3)** components of a hydraulic system at the hydraulic power supply section. (3 marks)
- (b) There are two types of hydraulic applications which are mobile hydraulics and stationary hydraulics. Briefly compare the differences between these applications. (4 marks)
- (c) Explain **four (4)** disadvantages of the microcontrollers, which are the reasons that microcontrollers are not suitable for being used in place of PLC applications. (8 marks)
- (d) Relay is one of the components which are commonly used in control circuits. **Figure Q4.1** illustrates a relay and its symbol.

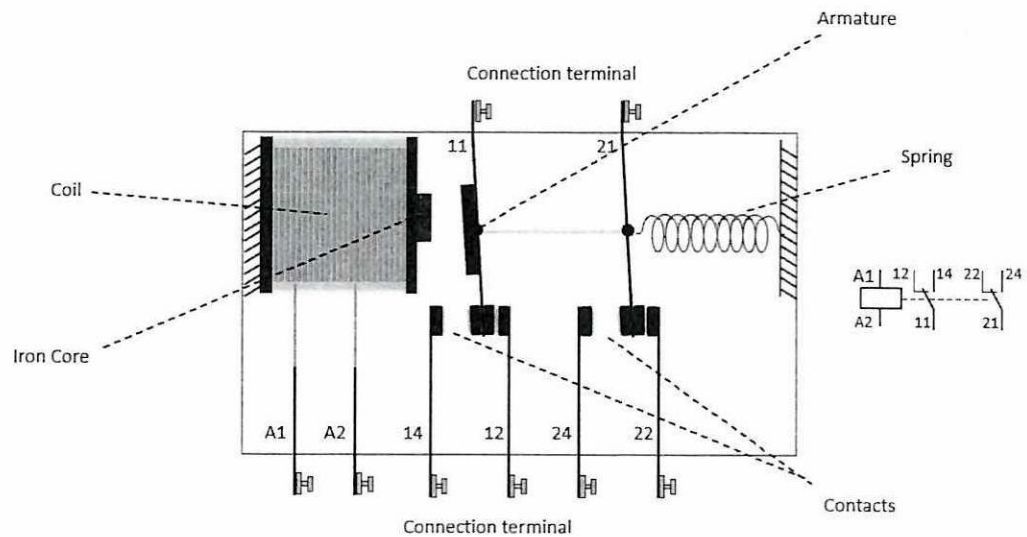


Figure Q4.1

By referring to the **Figure Q4.1**,

- (i) Name the type of the relay. (2 marks)
- (ii) Briefly explain how the relay works. (8 marks)

-END OF QUESTIONS -