Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	INDUSTRIAL MACHINERY CONTROL SYSTEM DESIGN
COURSE CODE	:	BBJ 31305
PROGRAMME CODE	:	BBJ
EXAMINATION DATE	:	JULY/AUGUST 2023
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS. 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **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 **EIGHT (8)** PAGES

Q1. (a) List **three (3)** characteristic of directional control valves.

(3 marks)

(b) Explain the function of air filter in air service unit.

(2 marks)

(c) Explain the function of air lubricator in air service unit.

(2 marks)

(d) Compare **two (2)** differences between single acting cylinder and double acting cylinder.

(8 marks)

(e) Refer to the **Figure Q1(e)**, briefly explain the operation of the circuit diagram.

(10 marks)

Q2. (a) State the definition of relay.

(2 marks)

(b) List **three (3)** example of input devices.

(3 marks)

(c) Optical proximity sensors make use of optics and electronics in order to detect object. There are several type of optical proximity sensors. One of them is diffuse optical proximity sensor.

(i) Sketch a diagram of how a diffuse optical proximity work with or without object detection.

(6 marks)

(ii) Explain how a diffuse optical proximity works.

(4 marks)

(d) By referring to the **Figure Q2(d)**,

(i) name the type of relay.

(2 marks)

(ii) briefly explain how a relay works.

(8 marks)

Q3. (a) Vacuum gripper is commonly use in Pick and Place Station in industrial automation system to transfer an object from one location to another location.

By referring to the **Figure Q3(a)**,

(i) name the **three (3)** components as labelled in the figure.

(3 marks)

(ii) list **two (2)** type of item label number 1.

(2 marks)

(iii) explain how item label number 2 works.

(4 marks)

(iv) explain the **four (4)** functions of item label number 3.

(8 marks)

(b) **Figure Q3(b)** below show a slide module that allows the sorting of workpiece between three different slides according to the characteristics of each workpiece. Based on **Figure Q3(b)**, classify the suitable sensor type and output signals (On or Off) from the respective proximity sensor so that it is possible to have unique signal combination to sort the workpiece accordingly using the **Table Q3(b).**

Table Q3(b)

Sensor / Workpiece		
Chrome-plated		
Red		
Black		

(8 marks)

Q4. (a) Time functions are an essential constituent for the programming of control systems because time-controlled actions or monitoring must be executed very frequently. **Figure Q4(a)** shows pulse timing diagram for three different types of IEC Timer.

Based on **Figure Q4(a)**,

(i) name the Timer A, Timer B and Timer C accordingly.

(3 marks)

(ii) briefly explain the mode of operation of Timer A, Timer B and Timer C.

(12 marks)

(b) **Figure Q4(b)** shows a pneumatic circuit diagram and electrical circuit diagram for distribution process of ejecting parts. By pressing a start button (PB1) and retract position (A0) is detected, cylinder is extend. After 5 seconds the cylinder has reached the extend position (A1), only then it is returned to its start position automatically. This cycle is running continuously until another stop button (PB2) is pressed or will automatically stop after 5 cycles counted. By pressing PB2 also will result to counter to reset. Design the control system using PLC Ladder Diagram program.

(10 marks)

-END OF QUESTIONS –

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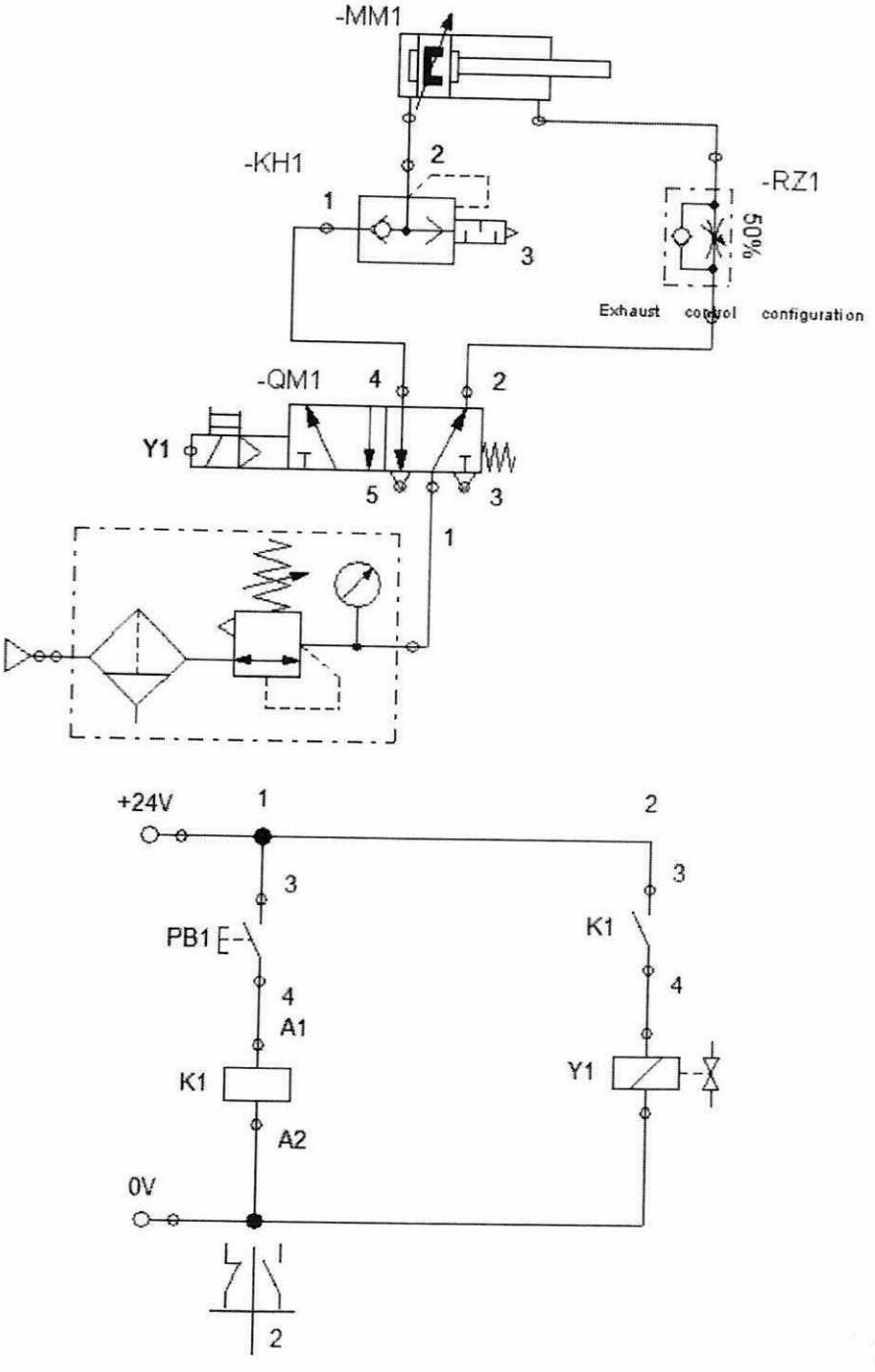

Figure Q1(e)

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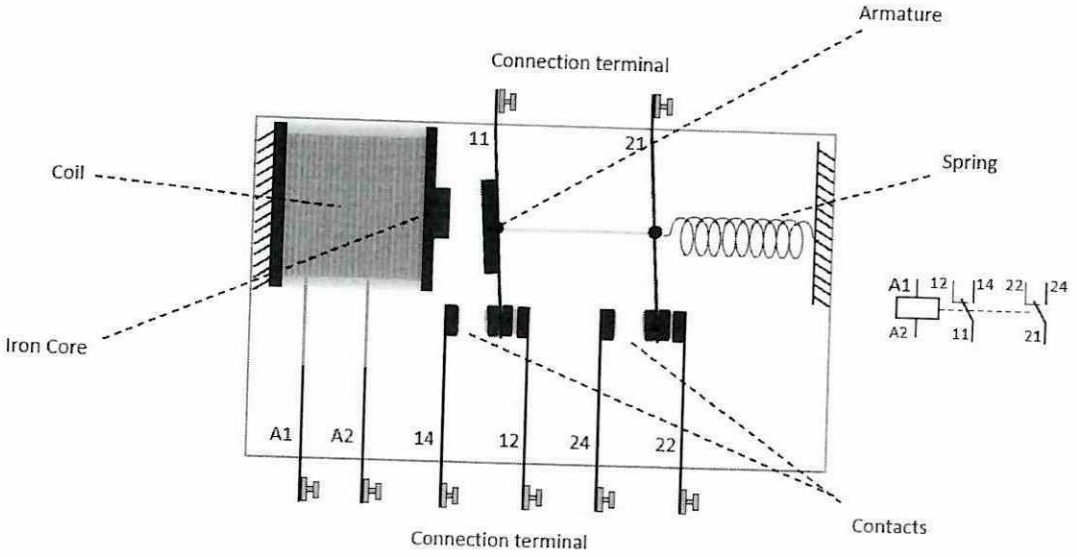

Figure Q2(d)

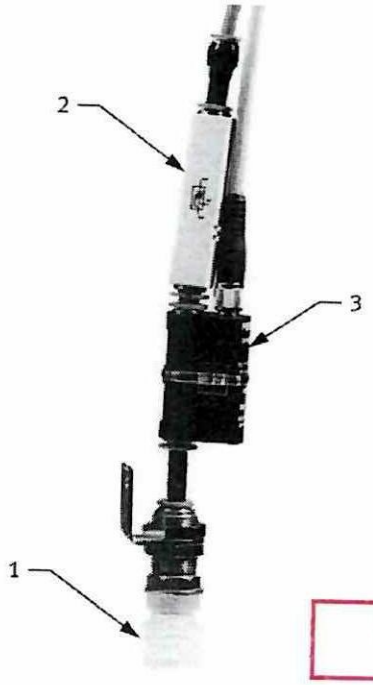

Figure Q3(a)

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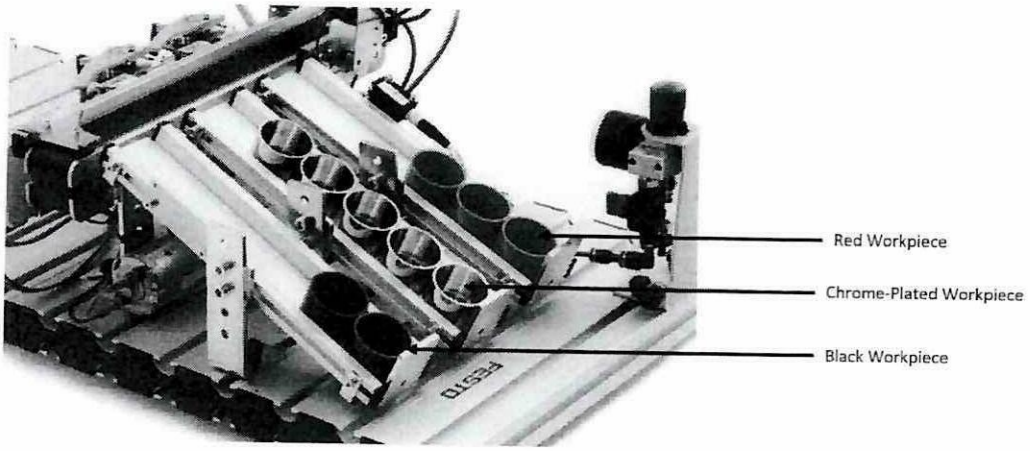

Figure Q3(b)

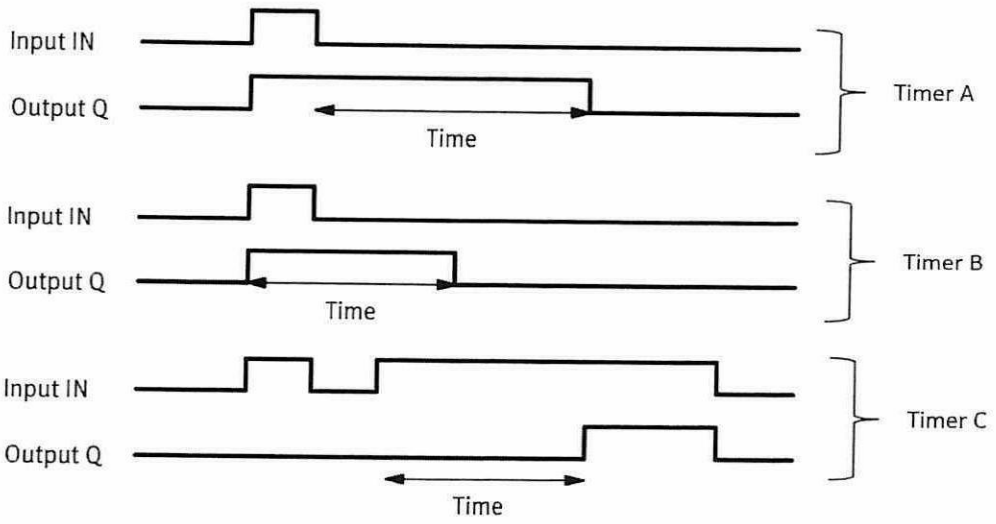

Figure Q4(a)

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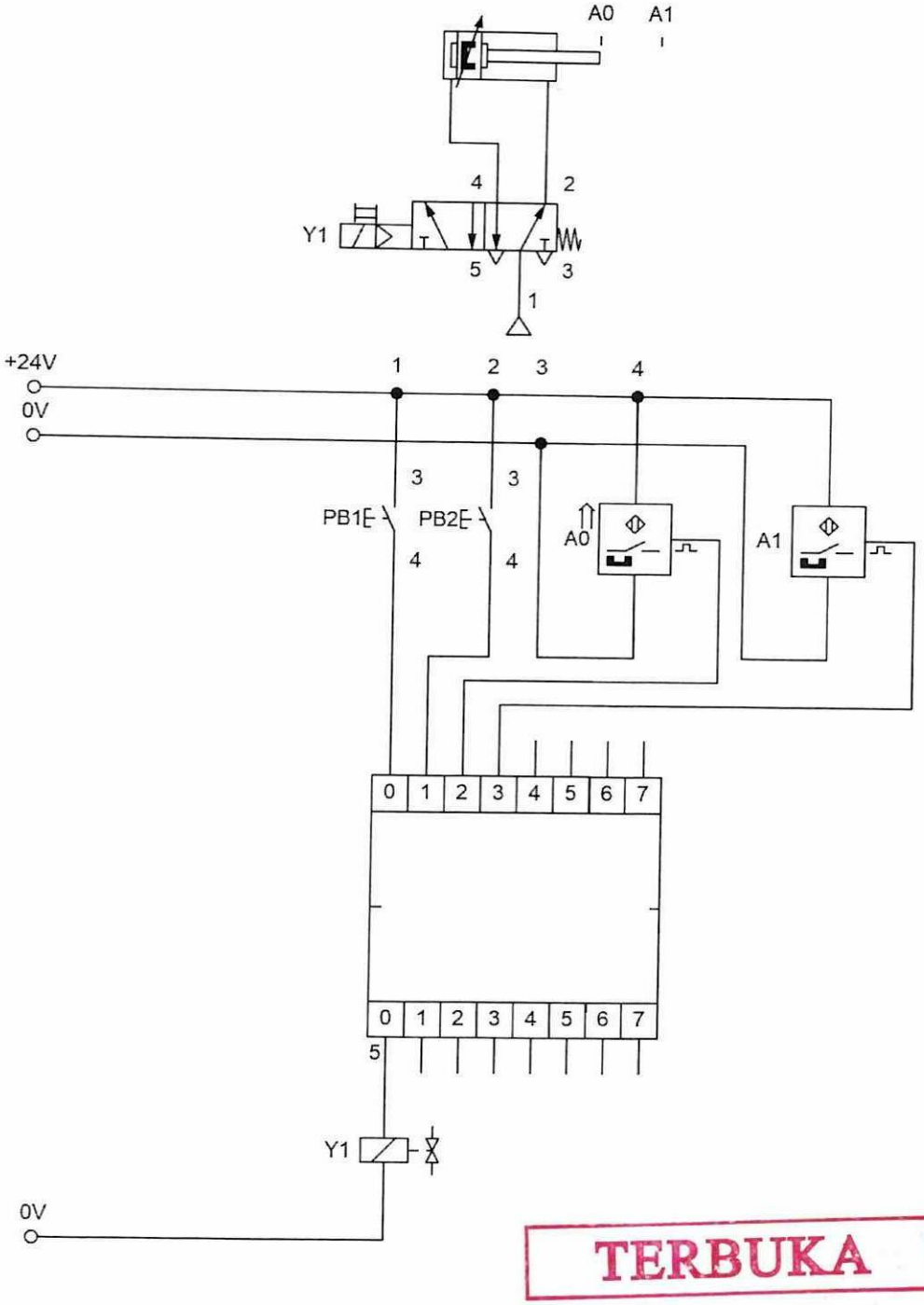

Figure Q4(b)