UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022

COURSE NAME	:	INDUSTRIAL ELECTRONICS
COURSE CODE	:	DAE 32003
PROGRAMME CODE	:	DAE
EXAMINATION DATE	:	JANUARY / FEBRUARY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS. 2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **OPEN BOOK.**

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

TERBUKA

Q1   (a)   The timer relay is a special function block commonly used in industrial application. The **Figure Q1(a)** shows the timer application and a ladder diagram developed in LOGO!Soft interface.
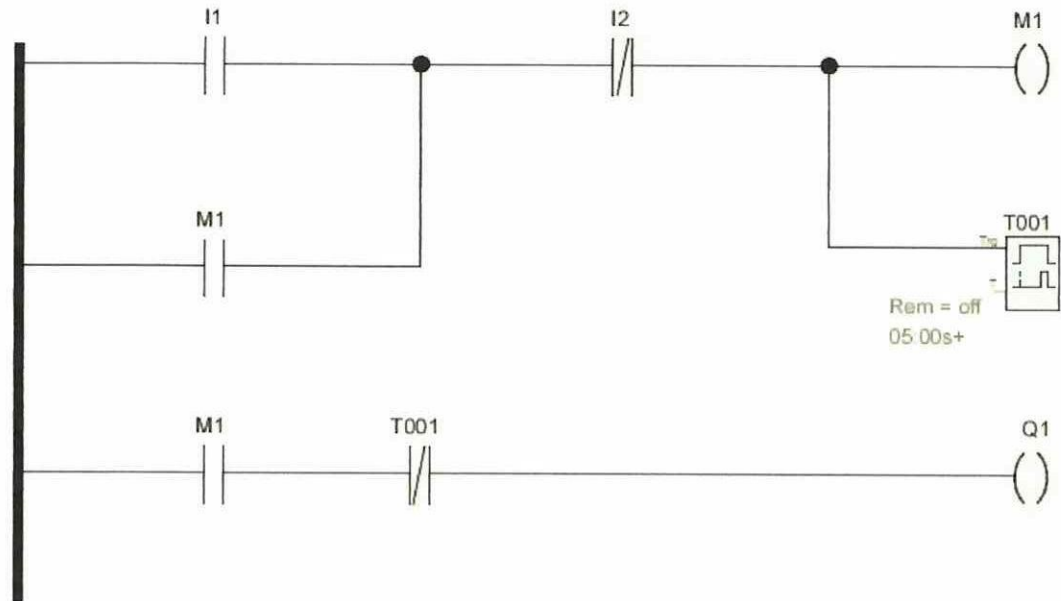

Figure Q1(a)

(i)   Classify the type of timer used in the ladder diagram.

(2 marks)

(ii)   Give the main function of I2 in the system.

(1 mark)

(iii)   Express the full operation of the system by assuming the input of I1 and I2 are the momentary switch type.

(5 marks)

(b)   Based on **Figure Q1(b)**, a type of timer is attempted to design other applications in the system.
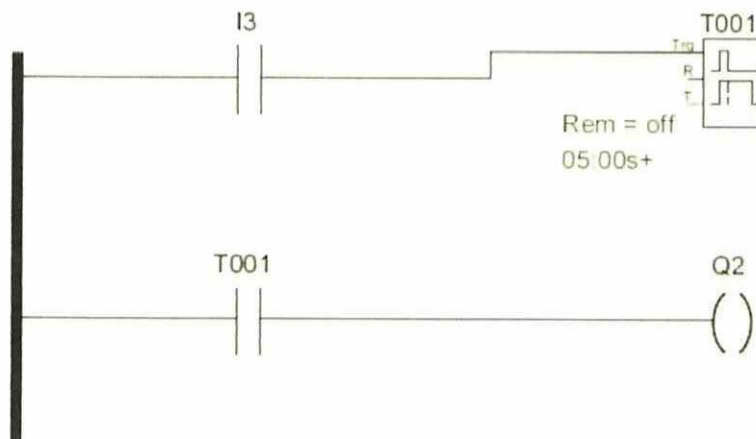

Figure Q1(b)

2

(i)   Classify the type of timer used in the ladder diagram.

(2 marks)

(ii)   Express the full operation of the system by assuming the input of I3 is the momentary switch type.

(5 marks)

(c)   Based on the full operation of **Figure Q1(a)** and **Figure Q1(b)** discussed above, determine the similarities and differences of both ladder diagrams.

(6 marks)

(d)   The **Figure Q1(d)** applies another type of relay in the system. Analyze the system's operation and the similarity functional with the two previous ladder diagrams, **Figure Q1(a)** and **Figure Q1(b)**.
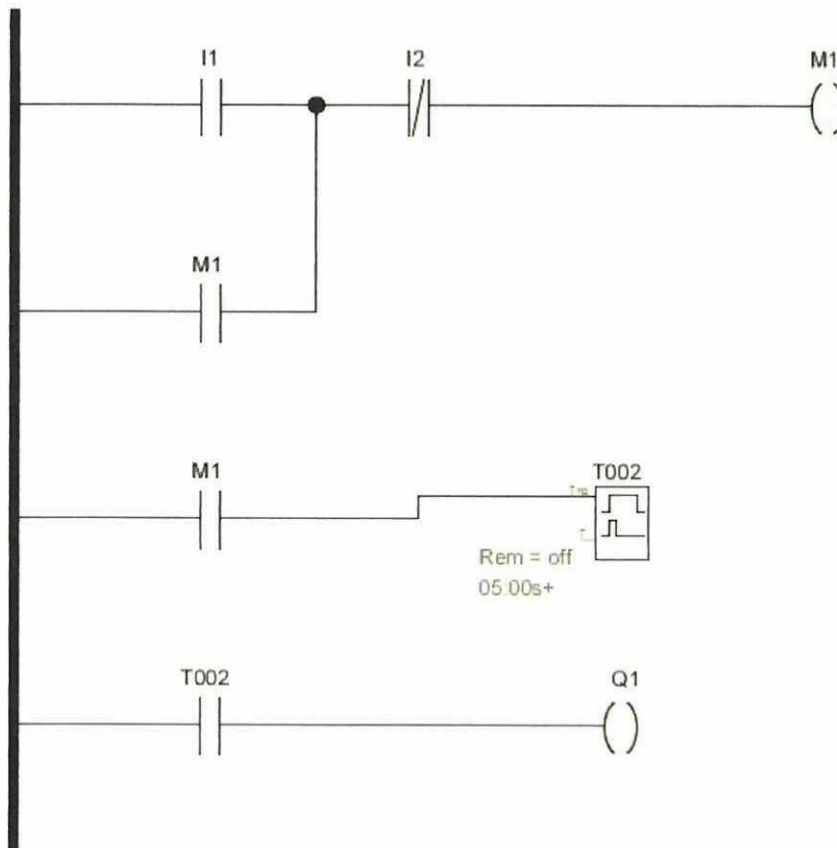

Figure Q1(d)

(4 marks)

CONFIDENTIAL

Q2 (a) **Figure Q2(a)** shows an electro-pneumatic circuit to operate an automatic system. The system actuates with pre-determined sequences based on the connected circuit.
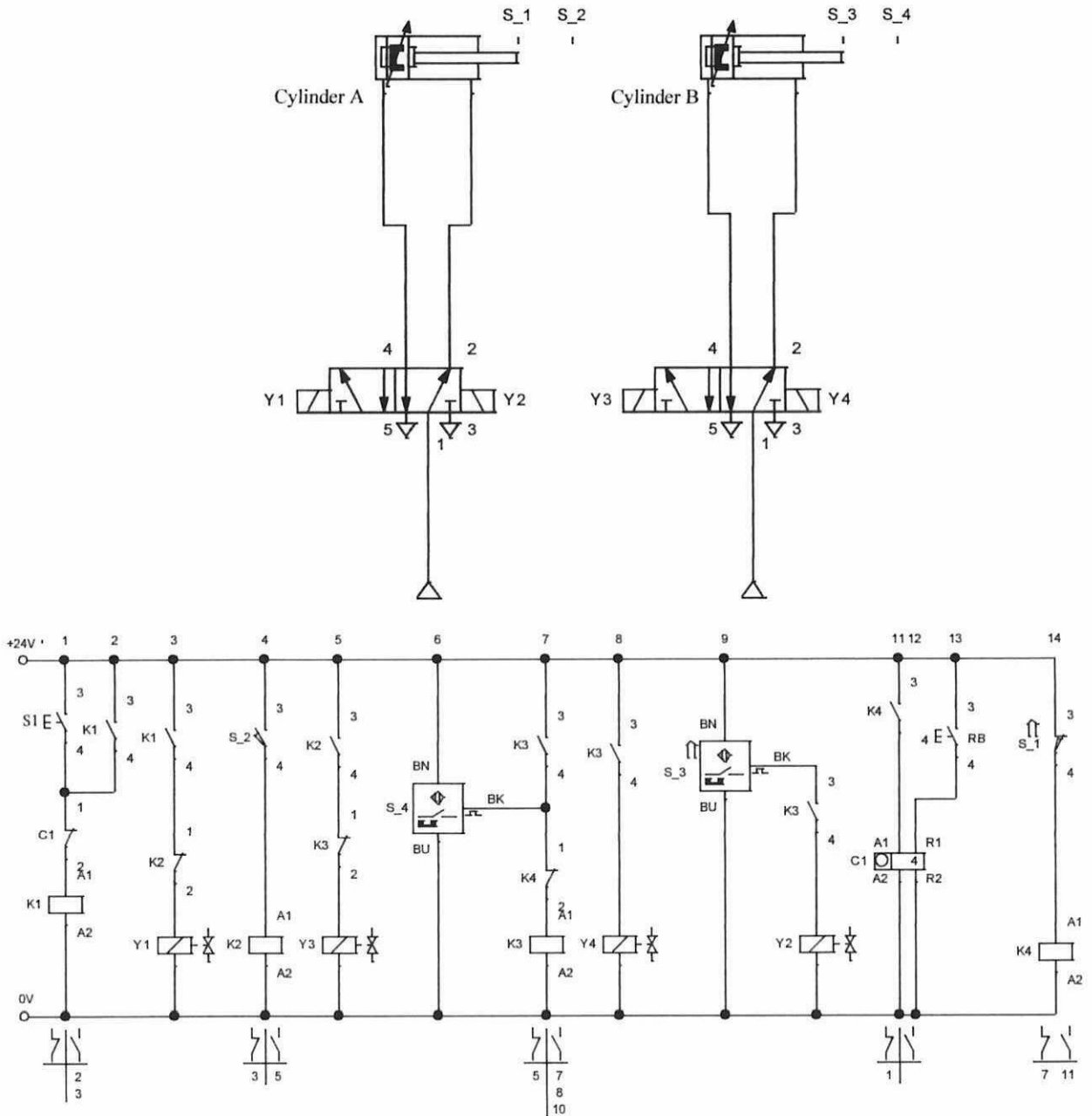

Figure Q2(a)

(i) Provide a list of components used and connected in the circuit.

(5 mark)

(ii) Explain the full circuit operation and predict the movement of the output sequence, Cylinder A and Cylinder B when switch S1 is pressed.

(10 marks)

4

(b)   Hydraulic system provides more pressure output in the certain developed application. **Figure Q2(b)** shows one of the electro-hydraulic diagram that installed in a industry system.
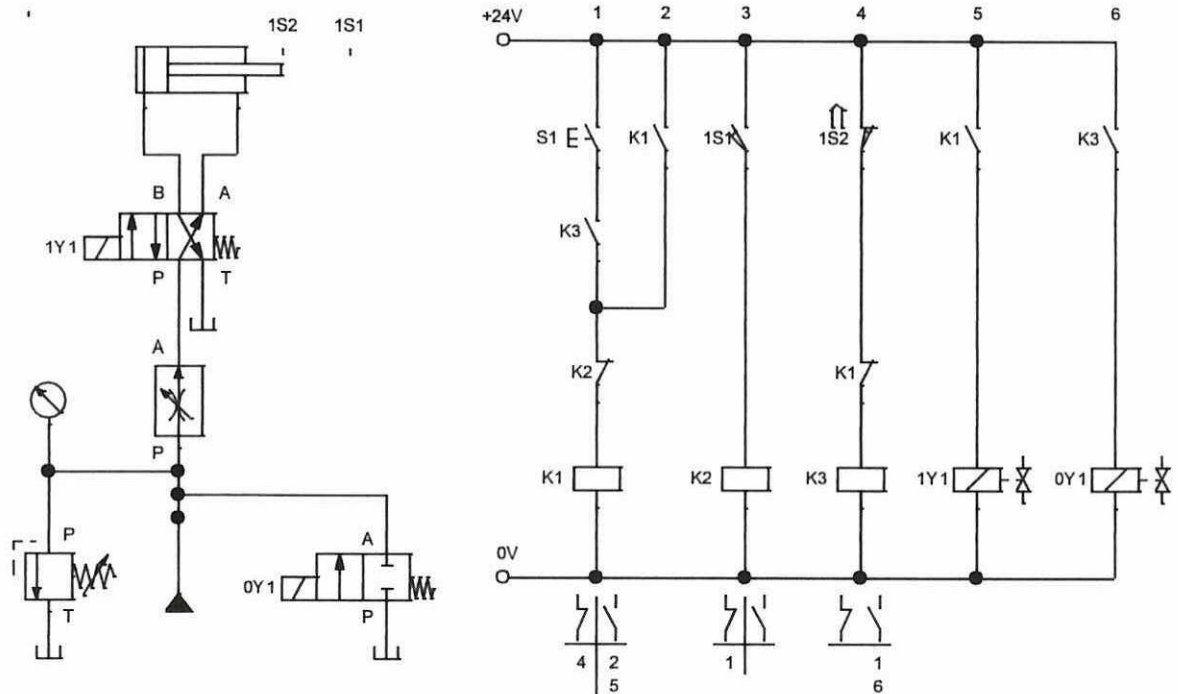

Figure Q2(b)

(i)   Determine how many relays used in the system and state the name labeled in the diagram.

(3 marks)

(ii)   Predict the full operation of the electro-hydraulic diagram above when switch S1 is pressed. Detail out the input and output elements of the system.

(7 marks)

Q3   (a)   Instruction list is one of the approach to program the PLC. Based on **Figure Q3(a)(i)** to **Figure Q3(a)(iii)**, transform it to the equivalent mnemonic code.
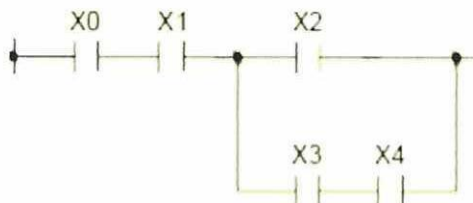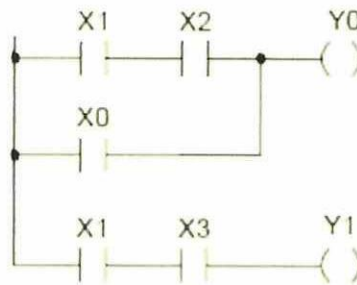
(i)

Figure Q3(a)(i)

(3 marks)

CONFIDENTIAL

(ii)

Figure Q3(a)(ii)
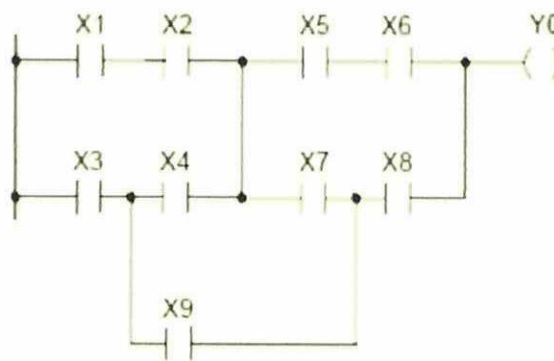
(3 marks)

(iii)

Figure Q3(a)(iii)

(5 marks)

(b) An application system is enabling the indicator to be ON after a 5-second delay and OFF after a 3-second delay by the switch. Express the equivalent ladder diagram to operate the system based on signal showed in the **Figure Q3(b)**.
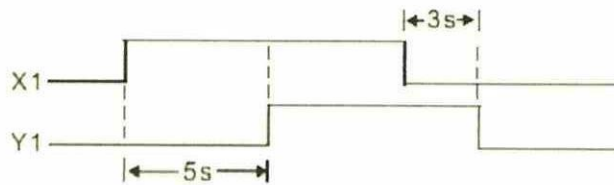

Figure Q3(b)

(6 marks)

(c) One open tank is installed in the plant as visualize in **Figure Q3(c).** The liquid level of the tank is controlled automatically. When liquid level reaches the level low, outlet flow is blocked and inlet flow is allowed until high level is achieved. When level high is detected, outlet flow is allowed and inlet flow is blocked. Draw the ladder diagram of the system to operate the fixed sequences.
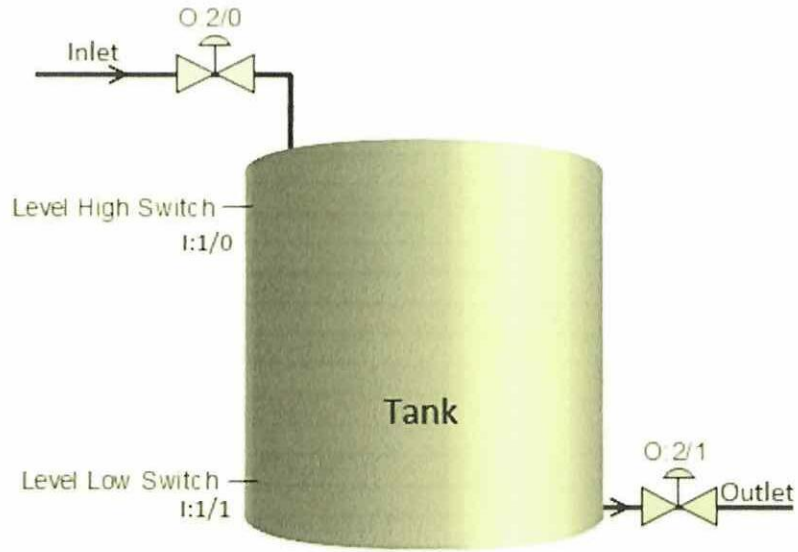
Figure Q3(c)

(8 marks)

Q4   (a)   State the name for X in **Figure Q4(a)**.

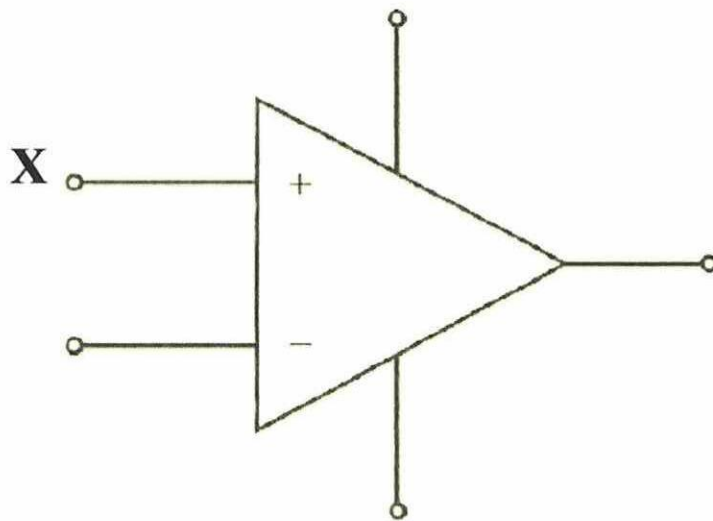**Figure Q4 (a)**

(1 marks)

(b)   Describe the difference between an inverting op-amp and a non-inverting op-amp using sketches.

(4 marks)

CONFIDENTIAL

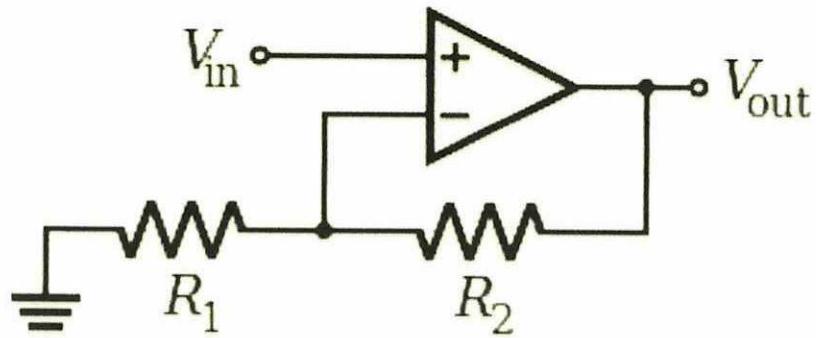(c) Derive the gain and output voltage for the op-amp circuit shown in **Figure Q4(c)**.

Figure Q4(c)

(6 marks)

(d) Explain an application of DC motor and stepper motor.

(4 marks)

(e) A 110 hp DC series motor rated 200 A is operating in a chopper circuit from a 400 V DC source. The armature and field inductance is 0.03H, at the minimum ratio t1/(t1 + t2) of 0.40. Find the pulse frequency to limit the amplitude of armature current excursion to 5A.

(3 marks)

(f) Calculate the number of steps per revolution and complete the **Table Q4(f)** below;

Table Q4(f)

Step angle	Steps per revolution
0.72	
1.8	
2.5	
7.5	

(2 marks)

(g) There are three techniques in operating a stepper motor. Demonstrate the Full Step Operation – 2 Phase On.

(5 marks)

– END OF QUESTIONS –

TERBUKA