INTI International College Penang

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**August 2021**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI)
Course	:	**EGE1101: Introduction to Programmable Logic Controller**
Date of Examination	:	8 December 2021 (Wednesday)
Time	:	8.00am – 11.00am Reading Time : Nil
Duration	:	3 Hours

Special Instructions :

This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks.

Material permitted :
Non-Programmable Scientific Calculator

Materials provided :
Nil

Examiner(s)	:	**Steven Khoo Boo Tap**
Chief Moderator	:	Dr Su Hsiao Wei

*This paper consists of **9** printed pages, including the cover page*

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEEI)
EGE1101: INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER
FINAL ALTERNATIVE ASSESSMENT: AUGUST 2021 SESSION

Instructions: This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks.

Question 1

(a) All PLCs contain different amounts of RAM and ROM depending on the design of the PLC manufacturer.

(i) Explain the reason executive memory is considered as part of the PLC's operating system.

(3 marks)

(ii) Explain the reason data memory is required in a PLC.

(3 marks)

(b) The central processing unit (CPU) is built into single-unit fixed PLCs while modular type PLC use a plug-in module.

(i) Illustrate the PLC processor module using an appropriate block diagram. The block diagram should also include other related modules.

(4 marks)

(ii) Explain those sections inside the processor module.

(3 marks)

(c) There are many advantages that a PLC system holds over a relay control system. Explain in detail the following two advantages of a PLC system over a relay control system.

(i) Ease of Troubleshooting

(3 marks)

(ii) Easy Expandability

(3 marks)

(d) Select ONE answer for each of the following sub-question and justify the reason for the selected answer.

(i) Basically, the main function of a PLC is to:
A. amplify various weak signal sources.
B. control a high voltage output with a low voltage input.
C. control the speed of motors.
D. make logical decisions and control outputs based on them.

(3 marks)

(ii) The scan time is the time required:
A. to record the status of all input and output devices.
B. to execute one cycle of the total program.
C. to record the status of all data communication devices.
D. for the information to pass from input to output.

(3 marks)

Question 2

(a) The methods used by user to communicate information with PLC is known as PLC programming languages as shown in Figure 2(a).

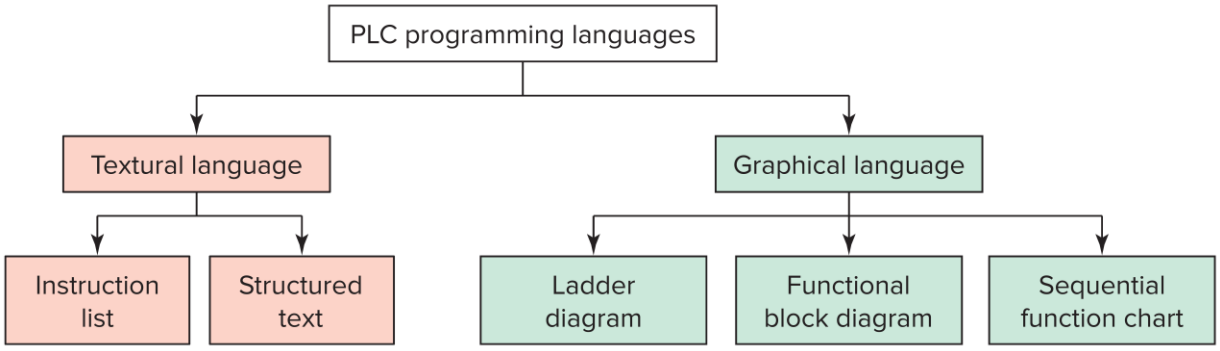

Figure 2(a)

(i) Explain all types of PLC programming languages: Graphical Languages and Textural Languages.

(5 marks)

(ii) Provide ONE (1) advantage and ONE (1) disadvantage of ladder logic diagram used as PLC language.

(3 marks)

(b) Using KV-N14DT Keyence PLC, produce a KV-script programming for the ladder logic diagram shown in Figure 2(b).

Hint: The length of the script should be as short as possible.

Figure 2(b)

(5 marks)

(c) A parking counter system as shown in Figure 2(c) is to be used to automatically count the number of cars entering and leaving using the same counter. An output light will be triggered and light up the "FULL" sign once the accumulated value equals to the preset value.

Conditions:

- Assuming that there is only single level parking in the system.
- The preset value used in this system is 120 cars.
- The type of sensors used in this system is Ultrasonic sensor switches. The enter sensor will be indicated by input R001 and the exit sensor is indicated by input R002 of the PLC. Use limit switch symbol to represent Ultrasonic sensor switches.
- The "FULL" sign will be indicated by output R500 of the PLC.
- The reset button will be indicated by input R005 of the PLC.

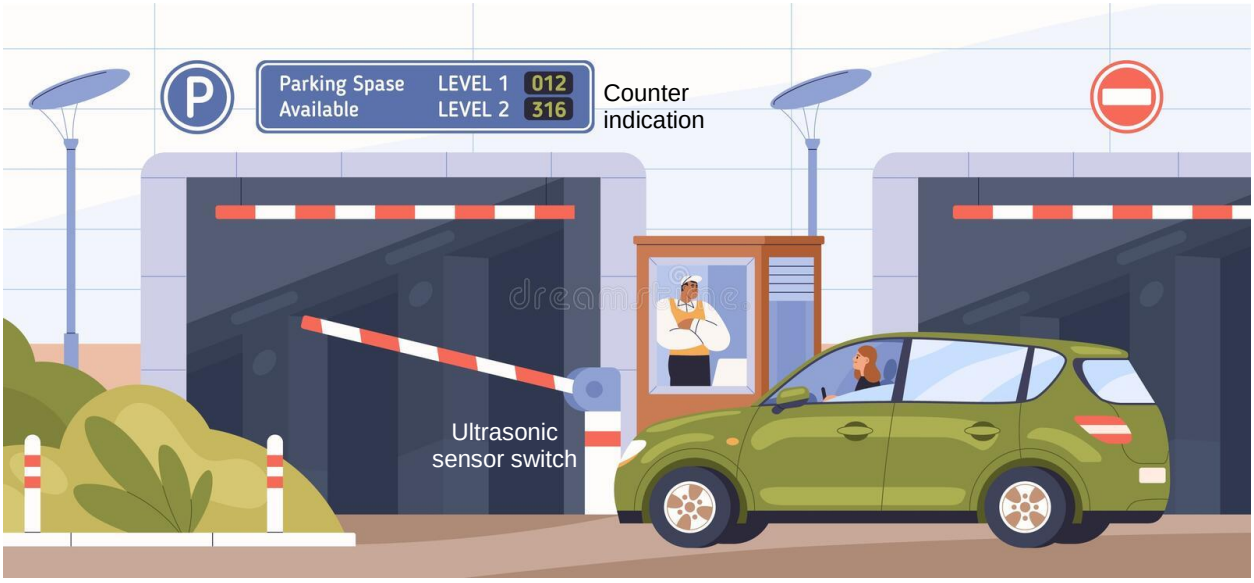

Figure 2(c)

Assume those sensors, pushbutton and output light can be operated with 24 VDC supply. The KV-N14DT PLC is being supplied with MS2-H50 switching power supply unit.

(i) Construct a relay schematic diagram using hardwired relay method with the aid of an industrial relay. Label all the components.

(4 marks)

(ii) Construct a ladder diagram using KV-N14DT PLC method with proper labelling. Comment TWO (2) limitations of using this up/down counter (UDC) for this application.

(8 marks)

Question 3

(a) Suggest THREE (3) different timers that can be used to produce 2.35 seconds delay. Show and explain with the aid of ladder diagram each type of timers used to produce the required delay.

(6 marks)

(b) Given the following mnemonics list of a PLC as shown in Table 3(b). Change the mnemonics list to ladder logic diagram and explain the function of the program.

Table 3(b)

Mnemonics	
LD	R001
AND	MR100
OUT	R501
LD	MR100
C	#1 #2 R001
LD	C1
OUT	R502
LD	R000
TMR	#0 #20
LD	T0
OUT	R500
END	
ENDH	

(7 marks)

(c) Justify how the processor handles the arrangement of series instructions of a rung programmed for a given ladder logic diagram as shown in Figure 3(c). Use the given figure to aid your explanation.

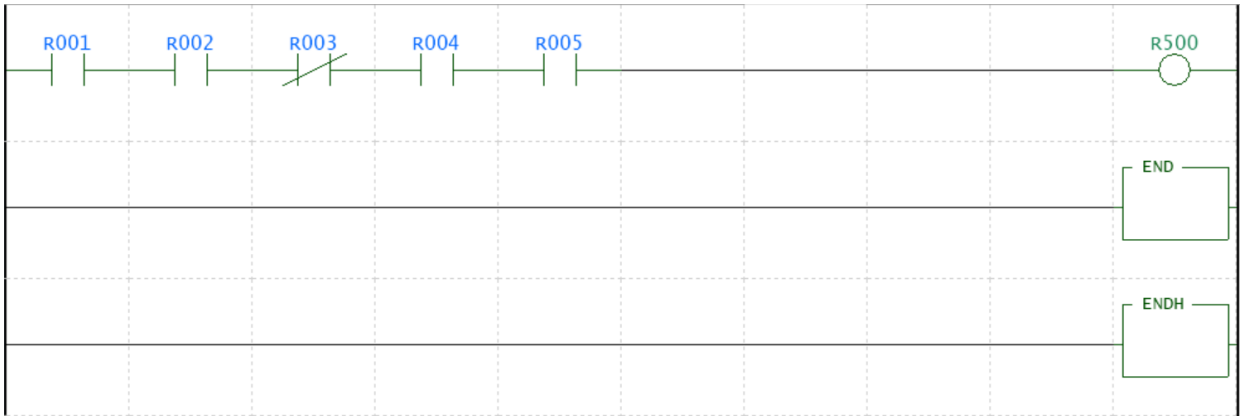

Figure 3(c)

(6 marks)

(d) An equivalent logic gate circuit of a PLC control system is shown in Figure 3(d). Construct the ladder logic diagram for the PLC control system shown in Figure 3(d). Also, provide the Boolean expression of output, Z. Input A (R001), input B (R002), input C (R003), input D (R004) and input E (R005) are represented by pushbuttons and output Z (R500) is represented by Pilot Light.

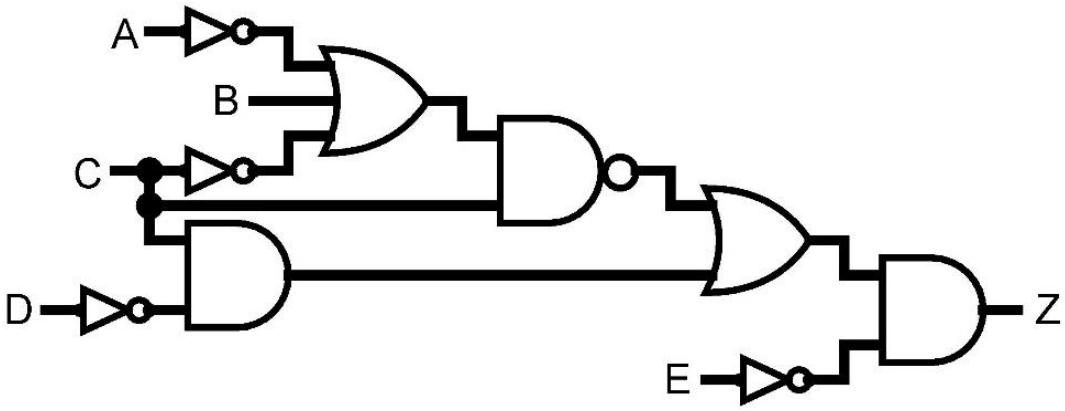

Figure 3(d)

(6 marks)

Question 4

(a) Figure 4(a) shows a 24VDC input module of a PLC. Show the complete wiring connection with the following connection information:

- Switch connects to Input 0 (IN 0)
- Pushbutton connects to Input 2 (IN 2)
- Proximity sensor connects to Input 4 (IN 4)
- Limit switch connects to Input 6 (IN 6).

All the devices are normally open (NO) type.
Use appropriate symbols for the devices.

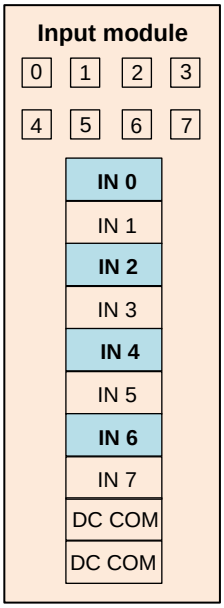

Figure 4(a)

(6 marks)

(b) Justify the mode of operation in most common configuration for the following photoelectric sensors shown in Figure 4(b)(i) and Figure 4(b)(ii):

(i) Thru-Beam Sensor.

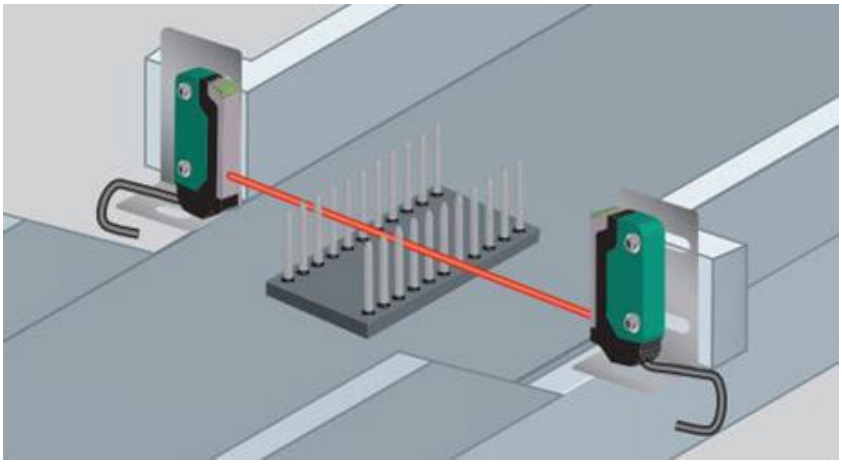

Figure 4(b)(i)

(3.5 marks)

(ii) Diffuse-Reflective Sensor.

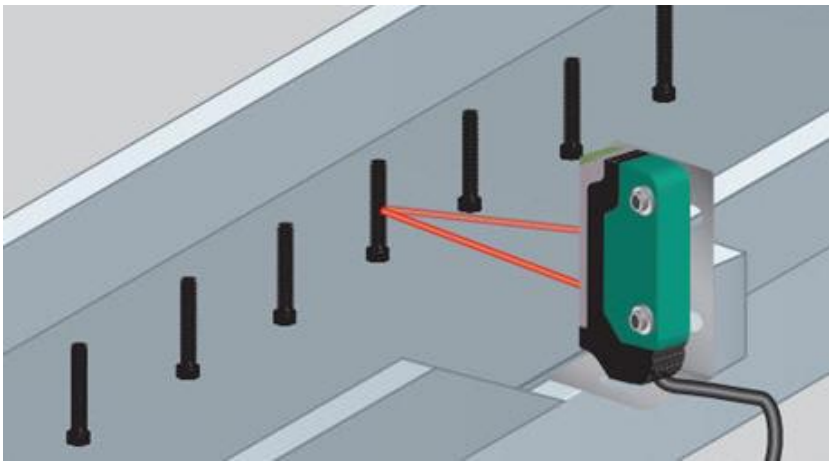

Figure 4(b)(ii)

(3.5 marks)

(c) A control system uses two start pushbuttons and two stop pushbuttons to control a motor. Only when both start pushbuttons are depressed, the motor runs. By the use of a seal-in contact, it continues to run when both start pushbuttons are released. Either stop pushbutton stops the motor when it is depressed.

Produce the ladder logic diagram of the control system and its equivalent logic gate circuit. Use label R001 and R002 for start buttons, label R101 and R102 for stop buttons and label R700 for motor in the equivalent logic gate circuit.

(8 marks)

(d) Construct an equivalent logic gate circuit for the ladder logic diagram shown in Figure 4(d). CR001 is the internal control relay like a normal contact. Indicate CR001 in the equivalent logic gate circuit.

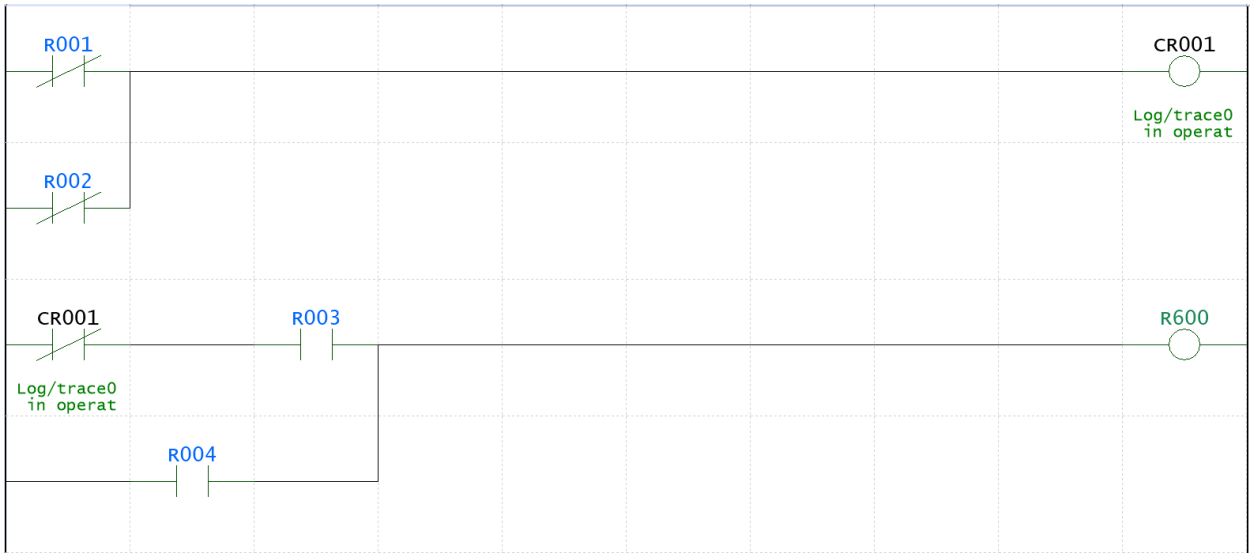

Figure 4(d)

(4 marks)

~THE END~