INTI International College Penang

FINAL
ALTERNATIVE ASSESSMENT

(COVER PAGE)

Session	:	**April 2021**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI)
Course	:	**EGE1101: Introduction to Programmable Logic Controller**
Date of Examination	:	27 July 2021 (Tuesday)
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	:	Johnny Wong Kee Hui

This paper consists of 7 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: APRIL 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) Present, with explanation, the reason system memory is considered as the scratch pad for the operating system.

(3 marks)

(ii) Present, with explanation, the reason user program 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. Illustrate the PLC processor module using an appropriate block diagram. The block diagram should also include other related modules. Also, explain those sections inside the processor module.

(7 marks)

(c) Briefly explain THREE (3) disadvantages of Relay Control System.

(6 marks)

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

(i) Modifying relay-type process control circuits usually involves changing the:
A. circuit wiring.
B. input and output circuit modules.
C. data communication circuit modules.
D. circuit operating voltage levels.

(3 marks)

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

(i) Present, with explanation, all types of PLC programming languages: Graphical Languages and Textural Languages.

(5 marks)

(ii) Explain the reason ladder logic diagram is the most commonly used in 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).

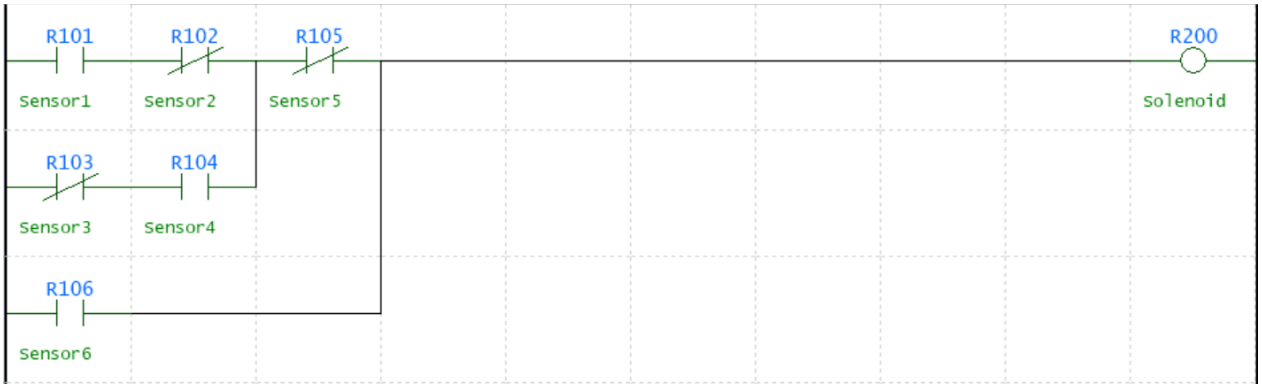

Figure 2(b)

(5 marks)

(c) A mixer motor as shown in Figure 2(c) is to be used to automatically stir the liquid in a vat when the temperature and pressure reach a preset value. A green lamp will indicate motor runs and a red lamp will indicate motor stops. A manual pushbutton control is allowed to operate at any pressure but not until a specified temperature setting has been reached.

Assume those sensors, pushbutton, motor and lamps 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.

(6 marks)

(ii) Construct a ladder diagram using KV-N14DT PLC method with proper labelling.

(6 marks)

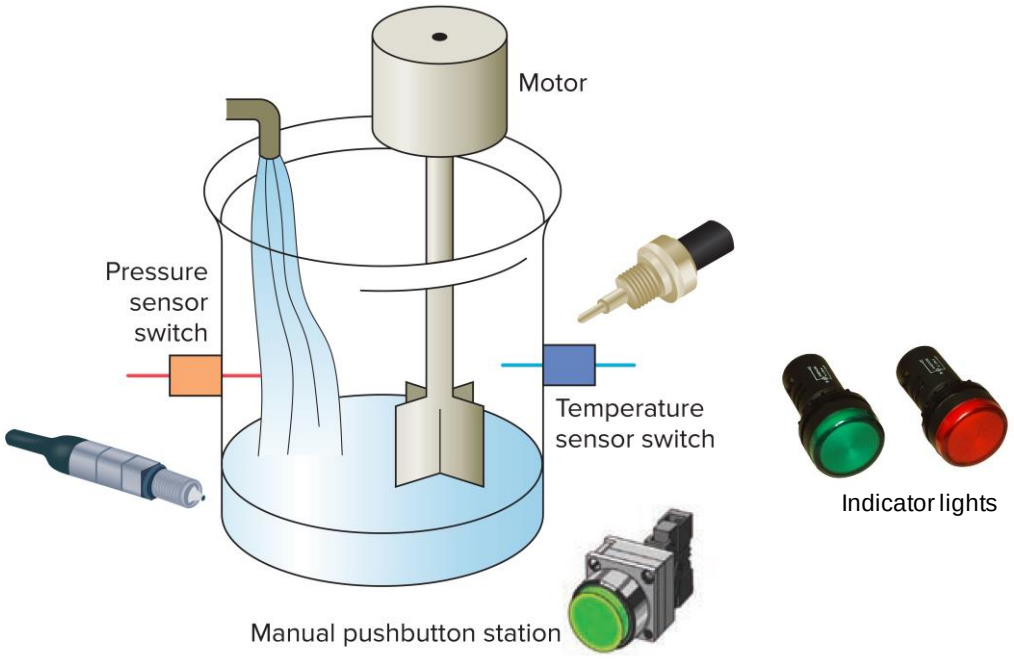

Figure 2(c)

Question 3

(a) Present the off-delay timer comparison table as shown in Table 3(a) that should cover the following:

(i) Off-delay timer with normally open, timed-open (NOTO) contact.

(3 marks)

(ii) Off-delay timer with normally closed, timed-closed (NCTC) contact.

(3 marks)

Table 3(a)

Off-Delay Timer Comparison	
NOTO: Symbol	NCTC: Symbol
NOTO: Explanation	NCTC: Explanation

(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	R002
AND	MR100
OUT	R502
LD	MR100
C	#1 #2 R002
LD	C1
OUT	R503

(7 marks)

(c) Justify how the processor handles the arrangement of series instructions of a rung programmed for a given ladder logic diagram. Use an appropriate diagram to aid your explanation.

(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. Inputs A, B, C, D, E and F are represented by Pushbuttons and output Z is represented by Pilot Light.

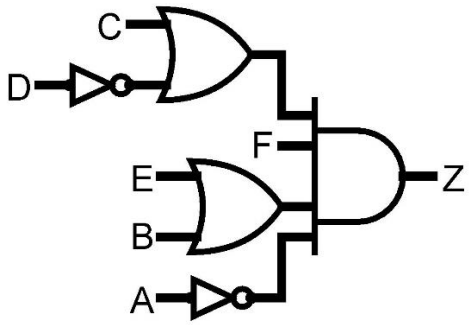

Figure 3(d)

(6 marks)

Question 4

(a) Illustrate with appropriate diagram for the following:

(i) A wiring diagram for switch, push button, proximity sensor and limit switch connect to a 24VDC input module of a PLC.

(3 marks)

(ii) A wiring diagram for motor, solenoid and pilot lamps connect to a 240VAC output module of a PLC.

(3 marks)

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

(i) Retro-Reflective Sensor.

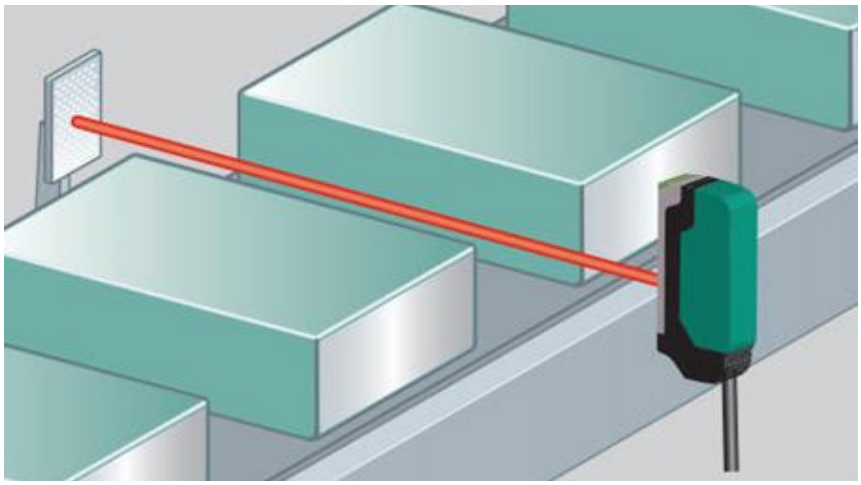

Figure 4(b)(i)

(3.5 marks)

(ii) Diffuse-Reflective Sensor.

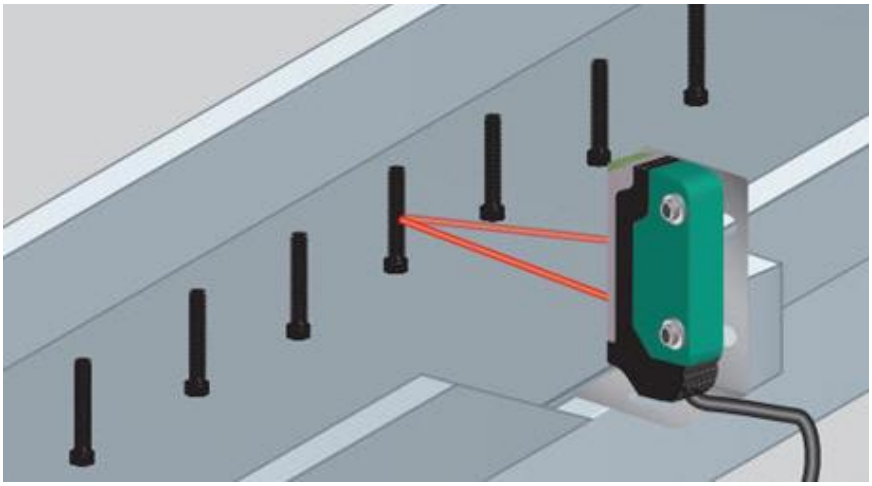

Figure 4(b)(ii)

(3.5 marks)

(c) A control system uses two start buttons and two stop buttons to control a motor. When either start button is depressed, the motor runs. By the use of a seal-in contact, it continues to run when the start button is released. Either stop button stops the motor when it is depressed.

Produce the ladder logic diagram of the control system and its equivalent logic gate circuit. Use label A, B, C and D for start and stop buttons and M 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).

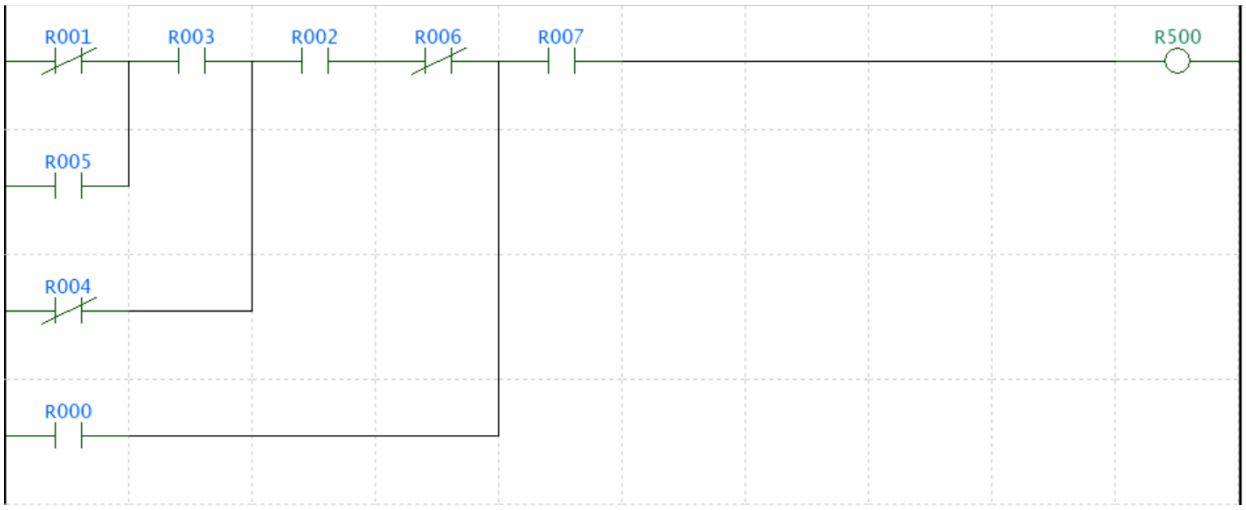

Figure 4(d)

(4 marks)

~THE END~