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SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2014 SESSION

SUBJECT CODE	:	**FAB 40604**
SUBJECT TITLE	:	**AUTOMATION SYSTEM DIAGNOSTICS AND MAINTENANCE**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**(3 HOURS)**
DATE	:	

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections. Section A and B. Answer ALL questions in Section A. For Section B, answer THREE (3) questions only.**
6. **Answer all questions in English.**
7. **A machine manual provided for all questions in Section B.**

THERE ARE 5 PAGES OF QUESTIONS EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

a) Briefly explain the role of ***pre-actuator*** in any automated system.

(2 marks)

b) List **three (3)** types of signals send by the sensor to the controller.

(3 marks)

c) Complete **Table 1** with the standard symbol of sensor, actuator and pre-actuator.

(5 marks)

Table 1: Symbols of actuator and pre-actuator

Index	Component	Symbol
1	5/2 way double solenoid valve	
2	Relay	
3	3 wires Inductive proximity sensor	
4	DC motor	
5	Rodless cylinder	

d) A pressure sensor connected to a transmitter which converts 0 - 8bar of air pressure to 0 – 10Vdc. Calculate the value of the pressure detected by the pressure sensor if the output of the transmitter is 5.5Volts.

(3 marks)

e) Illustrate the connection between a three wire photo electric sensors NPN type and input module channel 2 of Programmable Logic Controller (PLC) the input module of the PLC is current sinking.

(4 marks)

f) Suggest the suitable actuator to be used if the actioner is:

i. A metal steel marking tools. (1 mark)
ii. A mechanical gripper (1 mark)
iii. An escalator (1 mark)

Question 2

Figure 1 shows a cylinder shape metal handling machine. This machine will transfer a product (cylinder shape metal) from box I to box II. the product produced from box I will gliding to the end of the rail and detected by present sensor **(PP)**. Then the product will be grip by the gripper 1A and transferred to rail at box II by cylinder 2A. The machine will operate only when the In operation button **(InOper)** is pressed ON, and will stop if the Stop pushbutton is pressed. The machine is controlled by OMRON PLC CJ2M-cpu31.

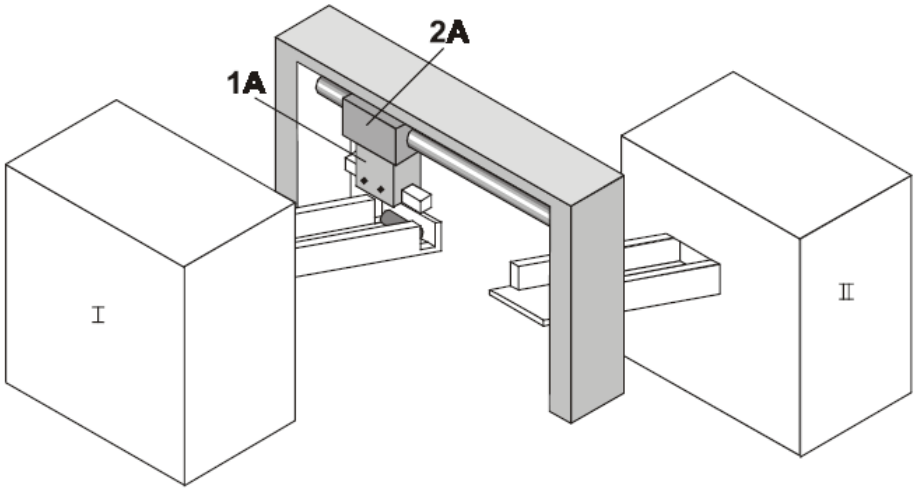

Figure 1: Cylinder shape handling device

***Table 2**: Input and output list of device*

Item	Description	PLC address	Symbol
1	Start Push button N/Open contact	Input: 0.00	InOper
2	Stop Push button N/Close contact	Input: 0.01	STP
3	Inductive proximity sensor PNP type 3 wires	Input: 0.02	PP
4	Solenoid valve to OPEN Gripper 1A	Output: 1.00	1A+
5	Solenoid valve to CLOSE Gripper 1A	Output: 1.01	1A-
6	Solenoid valve to transfer cylinder go to position II	Output: 1.02	2A+
7	Solenoid valve to transfer cylinder return to position I	Output: 1.03	2A-
8	Gripper close	Input 0.03	Grip
9	Gripper open	Input 0.04	NoGrip
10	Gripper at position I	Input 0.05	Pos1
11	Gripper at position II	Input 0.06	Pos2

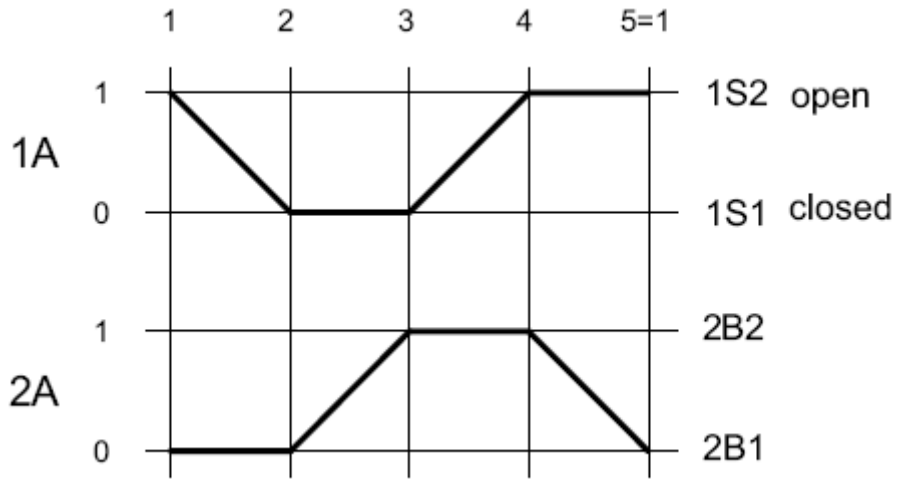

Figure 2: Step diagram of the cylinder

a) Draw the automated system structure for the system in **Figure 1**.

(4 marks)

b) Draw **Operational Function Chart** or **GRAFCET level 1** for the system.

(8 marks)

c) Draw **Technological Function Chart** or **GRAFCET level 2** for the system.

(8 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only THREE (3) questions.
Please use the answer booklet provided.
Please use the manual booklet of the Perfume Filling Machine provided.

Question 3

An **Operational function chart** or **Grafcet level 1** in manual booklet **page P39** is show a part of the sequence for the Perfume Filling machine. The function chart represents the sequence of the Cap Screwing Cycle.

a) Based on the Grafcet and the inputs and outputs list, draw the **Technological Function Chart** associate with the Grafcet given.

(10 marks)

b) Draw the transition (in ladder diagram) for the Grafcet.

(5 marks)

c) Draw the action (in ladder diagram) for the Grafcet.

(5 marks)

Question 4

a) Identify item labeled **Q1** in manual booklet **page P14**.

(2 marks)

b) Explain the important of the item labeled **Q1** any Automated System.

(3 marks)

c) Item with the symbol M3~ is a three phase motor which is actually the actuator for loading and unloading conveyor. Define the type of motor connection that has been made to this motor based on the machine manual booklet **page P14**.

(2 marks)

d) During the start-up of the machine in the morning, the operator found out that the turn table to transfer the bottle did not functioning. Using the troubleshooting techniques learned; rectify the cause of the problem by:

i. Draw the functional block diagram of the turn table process.

(5 marks)

ii. Do the brainstorming of the problem causes by completing the fishbone diagram given.

(5 marks)

iii. Suggest the most reasonable cause that makes the turn table didn't work. Justify the answer.

(3 marks)

Question 5

a) Explain the **GEMMA for the conveyor at page P60** of manual booklet.

(5 marks)

b) Draw the functional block diagram for the task called **Cap Screwing motor** works. Refer manual booklet.

(4 marks)

c) Draw the Ishikawa/Fishbone diagram if the capping screwing motor didn't operate.

(5 marks)

d) Suggest the most reasonable cause that makes the cap screwing didn't operate. Justify the answer.

(5 marks)

Question 6

Several modifications need to be made on the perfume machine.

a) First modification made is the double acting cylinder use to activate the pump-in pump-out mechanism is replaced by a single acting cylinder, but the double solenoid valve is remained as it's pre-actuator.

i. Draw the new pneumatic valve diagram involved.

(3 marks)

ii. With this modification made concerning the cylinder, the Grafcet program built in **page P35** is remained the same. Justify it.

(2 marks)

b) Second modification made: the double solenoid valve for **Transfer Cylinder (Turn Table)** to move forward and backward was changed to a single solenoid 4/2 way valve.

i. Justify whether the cylinder need to be change.

(3 marks)

ii. Draw the new pneumatic valve diagram for **the descent screwing**.

(3 marks)

c) Briefly explain the steps on how to replace a cylinder.

(4 marks)

d) List the preventive maintenance works of pneumatic parts in the system.

(5 marks)

End of questions