SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2014 SESSION

SUBJECT CODE	:	**FAB 11203**
SUBJECT TITLE	:	**AUTOMATION TECHNOLOGY**
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 two (2) question only.
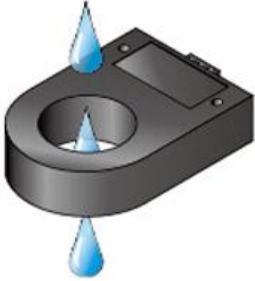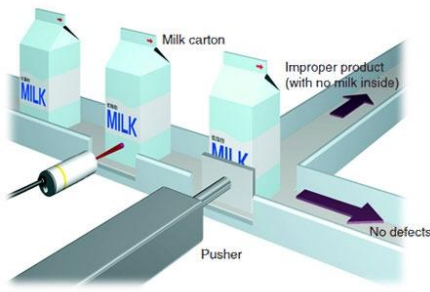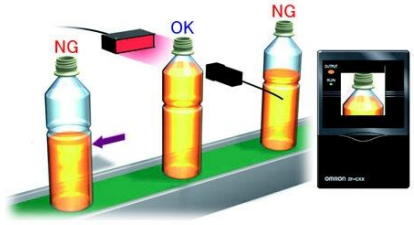
6. Answer all questions in English.

THERE ARE 7 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

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

Question 1

(a)   Describe **three (3)** types of signal that associated in automatic control system.

(3 marks)

(b)   Explain the general functions of pneumatic pre-actuator in any control system.

(2 marks)

(c)   Suggest the most suitable sensor for each application in **Figure 1.**

(6 marks)

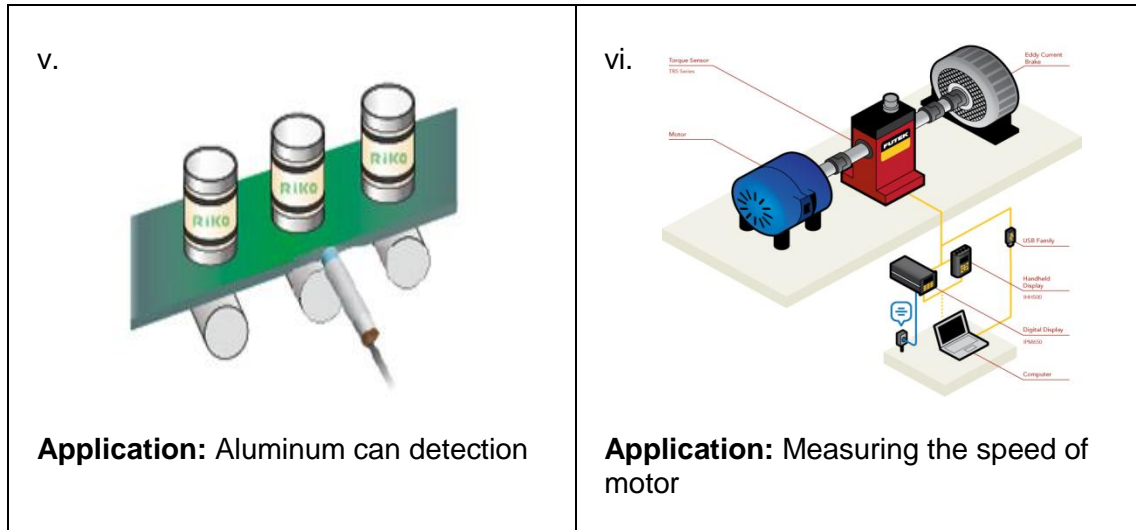|	
i. **Application:** Detection/Counting of screw	ii. **Application:** Liquid eye drop detection on liquid dispenser
iii. **Application:** Detection of boxes of milk at Dutch lady factory	iv. **Application:** Detection of water level in the bottles

Figure 1: Sensor applications

(d)   Explain the chosen between proximity inductive sensor and proximity capacitive sensor.

(3 marks)

(e)   Elaborate on functionality of inductive proximity internal circuit.

(4 marks)

(f)   Give **two (2)** types of limit switches and it methods of detection.
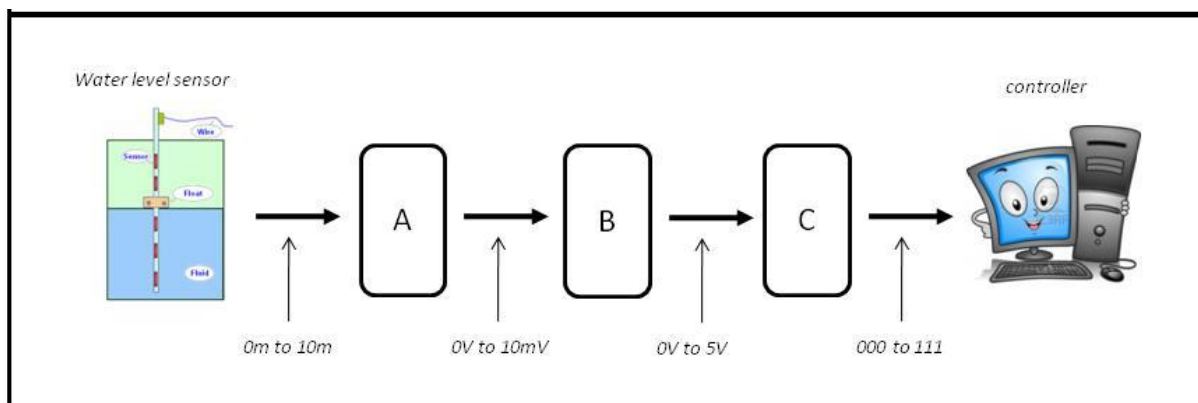
(2 marks)

Question 2

Figure 2: Water level application

(a)   In signal conditioning **Figure 2** shown the flow of the signal from the sensor to the controller. Name the treatment blocks A, B and C.

(3 marks)

(b)   Describe the operation of block C.

(3 marks)

(c)   State the advantages of using multi position cylinder compared to two position cylinders. Propose the suitable pneumatic pre-actuator to be used to control this kind of cylinder.

(3 marks)

(d)   State **three (3)** advantages of using of using Programmable Logic Controller (PLC) compare to conventional relays in controlling an automated system.

(3 marks)

(e)   Complete the truth table in **Table 1** by referring to logic circuit in **Figure 3.**
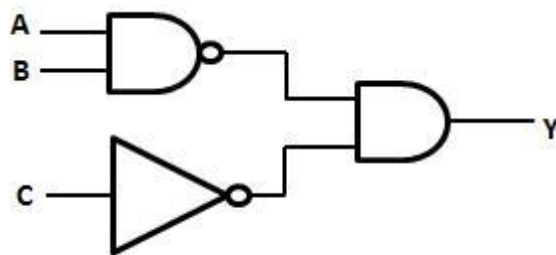
(8 marks)

Figure 3: Logic circuit

Table 1: Truth table of logic function

A	B	C	Y
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 3

(a)   Draw a control wiring circuit based on the explanation below:

(10 marks)

- When we push either start button 1 (ST1) or start button 2 (ST2), Contactor 1 (KM1) will energize.
- At the same time green light (LG) will ON.
- When the limit switch (LS) detect one object, KM1 and green light will OFF. But Contactor 2 (KM2) will energize and red light (LR) will ON
- The operation will stop when we push the stop button (STOP)

Note: Don't forget to insert the self-holding circuit/latching using relay (KA1)

(b)   Convert the electric schematic diagram in **Figure 4** below to logic circuit diagram.
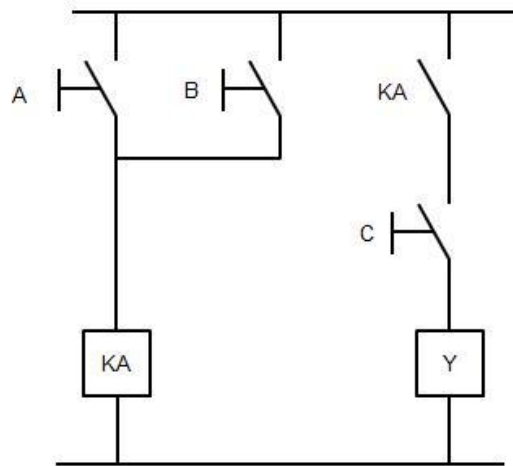
(6 marks)

Figure 4: Basic electrical circuit

(c)   Derive the question of the logic circuit diagram in question **3 (b).**

(4 marks)

Question 4

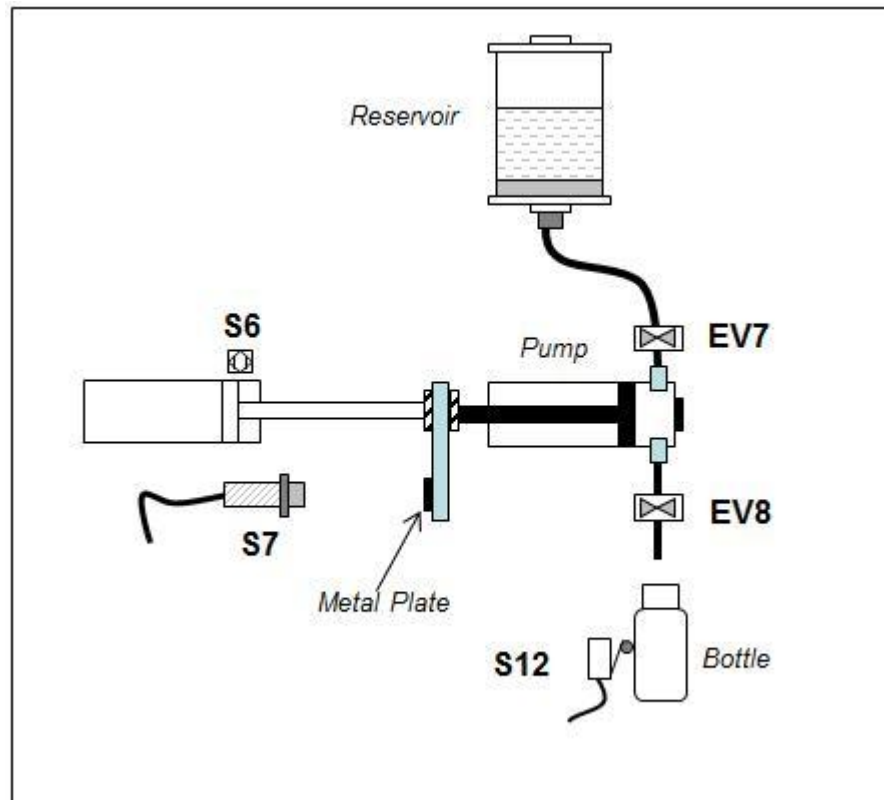(a)   Answer the following questions according to the system description.

Figure 5: Liquid Filling System

System Operation:

The automated system in Figure 5 operates as a liquid filling into the bottle. Sensor S12 detects the presence of the bottle which activates the filling process. The filling process will begin with the activation of EV7 then the cylinder will retract (pump in liquid) until S7 detect the metal plate. After pump in operation the EV7 will de-energize and followed by EV8 energize, then the cylinder will extend (pump out) and the liquid will be filled into the bottle. When S6 detected (cylinder fully extend), the EV8 will de-energize. The system will stop until new bottle inserted.

i.   Determine the suitable type of **S6**, **S7**, **S12**, and the possible controller, pre-actuator, actuator and input components to be used in this system.

(7 marks)

ii.   Draw the functional block diagram that describes the relationship between each component.

(3 marks)

iii.   If the manufacturer is recommended to use a proximity sensor for **S7**, discuss the type of S7 with it sensing distance and installation.

(5 marks)

iv.   Propose other method that's suitable to do the liquid filling process.
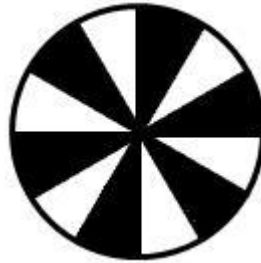
(5 marks)

Question 5

Figure 6: Rotary encoder system for mobile robot training kit

Given the optical disc radius, r is 450 mm and the disc is divided into 12 divisions, 6 black and 6 white. This disc equipped with a u-shape photoelectric sensor to become a simple encoder for mobile robot training kit. One pulse of this encoder is considered the detection from black to white.

(a)   Calculate the circumference of the disc.

(4 marks)

(b)   If the distance of the mobile robot moved from one place to another is 50cm, calculate the number of pulse created by the encoder.

(4 marks)

(c)   Calculate the number of pulse represent a distance of 80cm.

(4 marks)

(d)   Discuss the differences between incremental encoder and absolute encoder.

(4 marks)

(e)   Discuss the usage of the rotary encoder in controlling the speed of motor.

(4 marks)

Question 6

(a)   A **CIM** comprise of level 1, 2, 3, and 4 as shown in **Figure 7**. Identify each level of hierarchy in an automated factory.
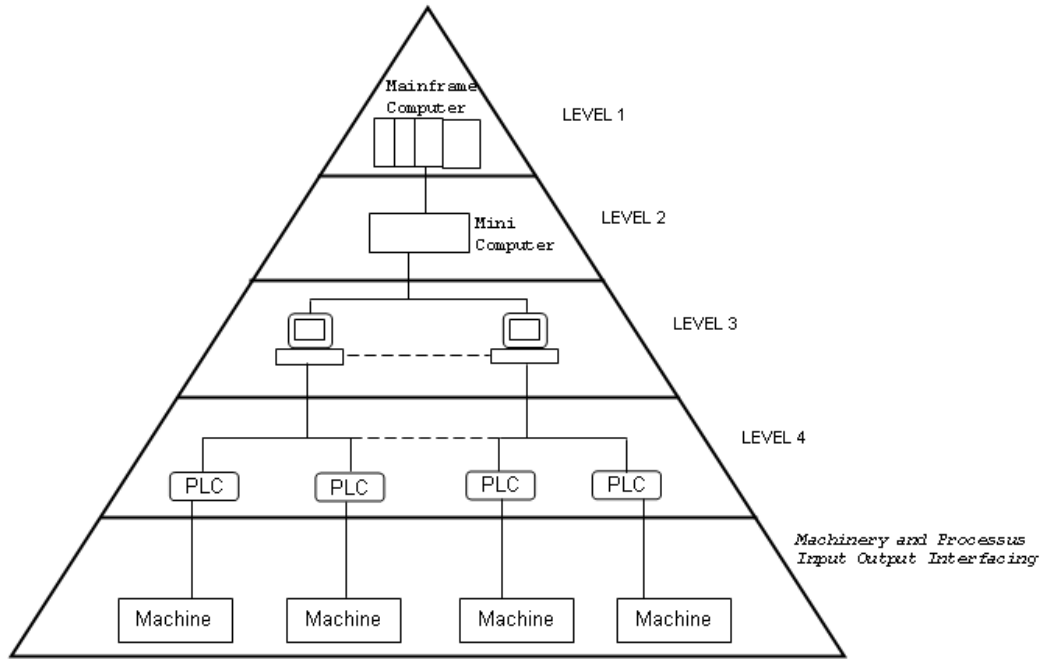
(8 marks)

Figure 9: Hierarchy in an automated factory

(b)   The concept of Flexible Manufacturing System (FMS) is applicable to a variety of manufacturing operations and most widely applied in machining operations.

    i.   Name **four (4)** basic components of typical FMS

(4 marks)

    ii.   Give **three (3)** advantages of **FMS** implementation

(6 marks)

(c)   Define **CNC**.

(2 marks)

END OF QUESTION