



**UNIVERSITI KUALA LUMPUR
Malaysia France Institute**

**FINAL EXAMINATION
SEPTEMBER 2014 SESSION**

SUBJECT CODE : FAD 10002 & FAD 10102
SUBJECT TITLE : INTRODUCTION TO AUTOMATION &
SENSOR TECHNOLOGY
LEVEL : DIPLOMA
TIME / DURATION : 9.00 AM – 12.00 PM
(3 HOURS)
DATE : 31 DECEMBER 2014

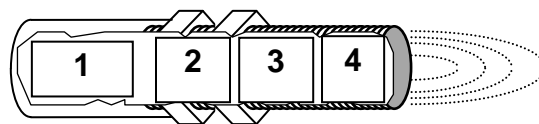
INSTRUCTIONS TO CANDIDATES

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.
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THERE ARE 9 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)**INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.****Question 1**

- (a) Define automated system. (2 marks)
- (b) Give **three (3)** benefits of using Automation. (3 marks)
- (c) There are **three (3)** basic elements in automation system. List and briefly explain these elements. (3 marks)
- (d) Define sensor and give **two (2)** examples of sensor. (4 marks)
- (e) List **two (2)** advantages and **two (2)** disadvantages of limit switch. (4 marks)
- (f) **Figure 1** shows the composition of proximity sensor.

**Figure 1:** Composition of proximity sensor

- i. Identify the element in blocks 1, 2 and 3. (3 marks)
- ii. There are two types of element in block 4 in a proximity sensor. Identify each element. (2 marks)

Question 2

(a) List **three (3)** different form of photo-electric detector. (3 marks)

(b) Draw the wiring diagram of PNP 3-wire photoelectric sensor. Use an indicator light as the load (3 marks)

(c) Suggest the most suitable sensor for each application in **Figure 2**.

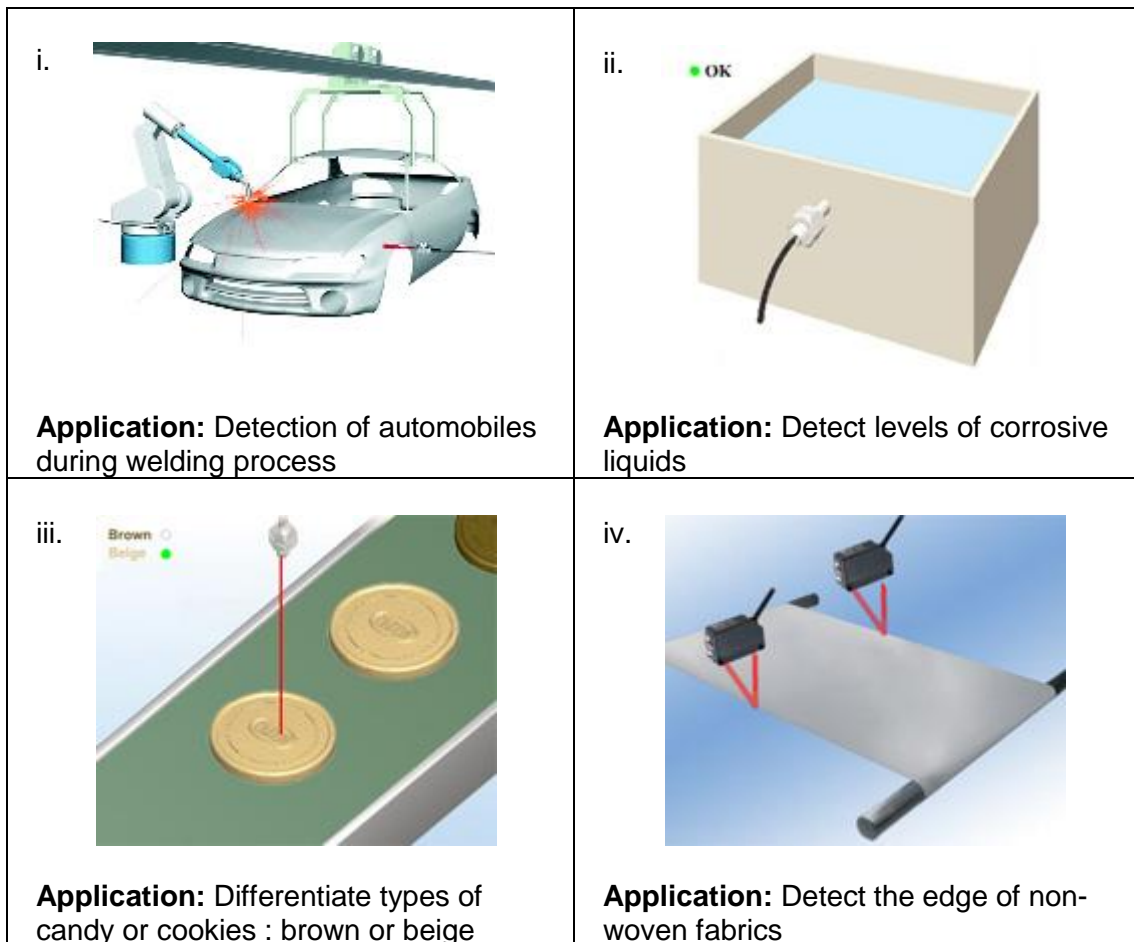


Figure 2: Sensor applications

(4 marks)

(d) Name the type of Transducer for the change of energy below:

- i. From light energy to voltage
- ii. From temperature to voltage

(2 marks)

- (e) The technician need additional sensor to measure the temperature of the water, thus he decided to use thermocouple temperature sensor as in **Figure 3**. The water temperature range is from 0 to 200°C Calculate the net voltage produced by thermocouple if the hot junction produce 100mV at 150°C and 15mV at cold junction at 17 °C

(3 marks)

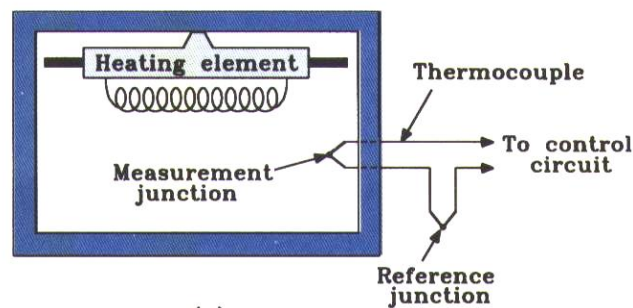


Figure 3: Thermocouple sensor

- (f) Based on **Figure 4**, calculate the value of R_f . Given that $R_{in} = 1k\Omega$, $V_{out} = 13.5V$, $V_1 = -15V$, $V_2 = 15V$.

(4 marks)

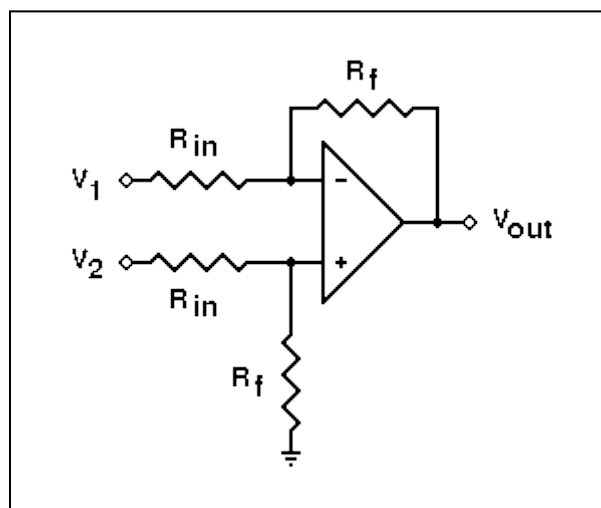


Figure 4: Differential amplifier circuit

Question 3

- (a) List and explain **two (2)** advantages using programmable logic controller (PLC) in automated system.

(4 marks)

- (b) Complete the truth table in **Table 1** below by referring to **Figure 5** for each type of logic function.

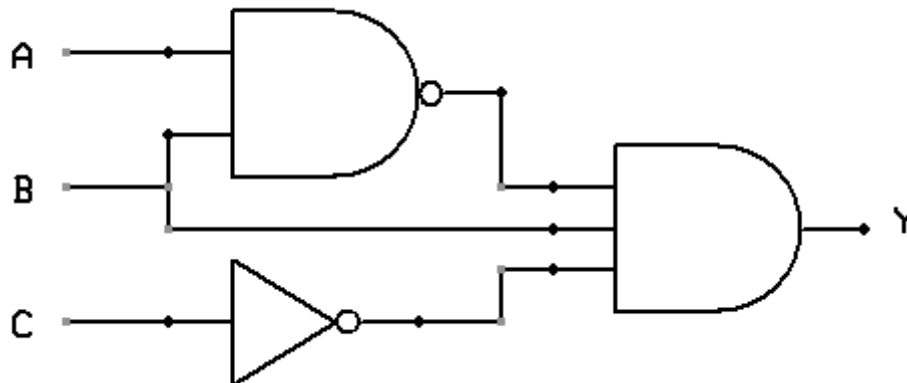


Figure 5: Logic function

Table 1: Truth table of logic function

a	b	c	y
0	0	0	
0	0	0	
0	1	0	
0	1	0	
1	0	1	
1	0	1	
1	1	1	
1	1	1	

(8 marks)

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

(8 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.

Please use the answer booklet provided.

Question 4

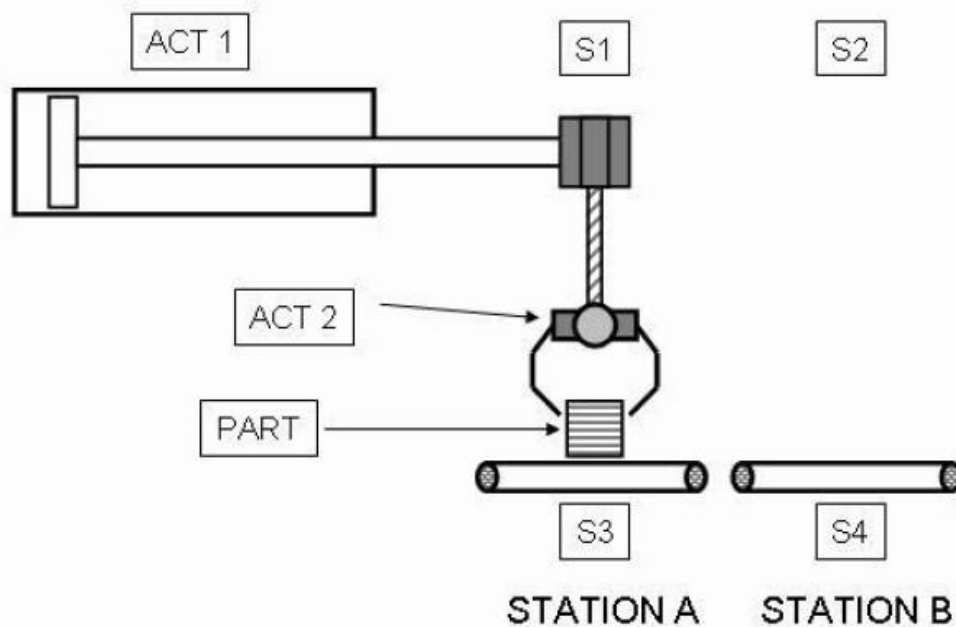


Figure 6: Pick and Place system

System descriptions: This is a pick and place system in **Figure 6**, consist of 4 sensors, 1 controller and 2 actuators. The task is to transfer the PART from station A to station B.

- (a) List down all the input and output devices that used in the system. (4 marks)

- (b) S3 and S4 is the sensor to detect the presence of PART in station A and station. Define the suitable sensor to be used for S3 and S4 if:
 - i. PART to be detect is metal
 - ii. PART to detect is wood. (2 marks)

- (c) Define and explain the actuator that can be used as ACT 2. (4 marks)

(d) State the suitable controller that can be used in this system and justify your answer.
(4 marks)

(e) Explain the function of the overall system.
(6 marks)

Question 5

(a) Element A takes the temperature signal and transforms it to resistance signal, element B transform the resistance signals into current signal, and element C transform the current signal into a display movement of a pointer across a scale. What is element A, B, and C? Illustrate your answer using a block diagram.
(6 marks)

(b) During winter season (in Europe), the temperature will drop until 0° celcius. A hotel management has installed one automated system that can work automatically in order to maintain the temperature in hotel rooms to be at 27° celcius constantly.

i. Select a suitable sensor, processor and actuator that can be used in the system.

Note: You should choose the best actuator for this system

(6 marks)

ii. With the aid of a block diagram, explain briefly how the system works.

(8 marks)

Question 6

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

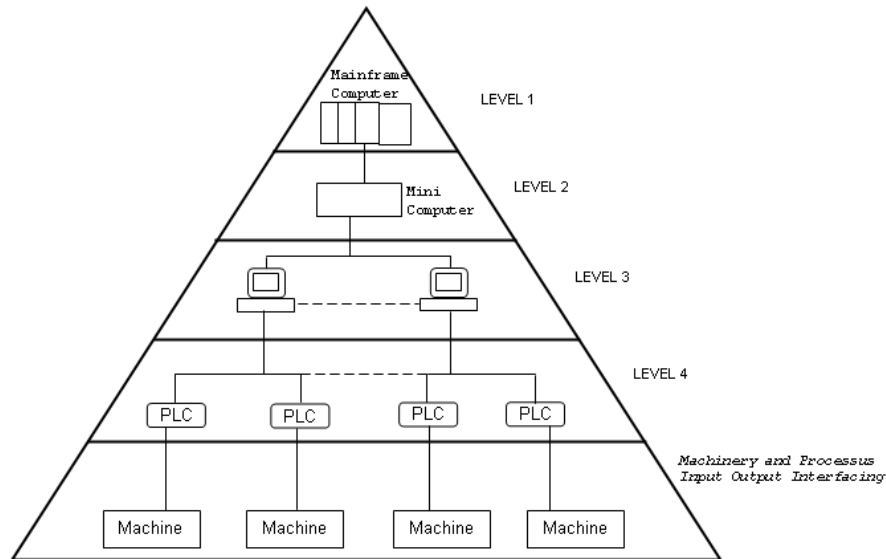


Figure 7: Hierarchy in an automated factory

- i. Define **CIM**. (2 marks)
 - ii. Identify each level of hierarchy in an automated factory. (4 marks)
- (b) A Flexible Manufacturing System (FMS) is one of the element exist in a CIM.
- i. State the level of hierarchy in which FMS is located. (2 marks)
 - ii. A typical FMS consist of Conveyor system and three (3) others elements. List the **three (3)** elements of FMS. (3 marks)

(c) **Figure 8** shows an automated conveyor system. The conveyor will stop if the package touches LS1.

i. Define all input and output devices in the system.

(6 marks)

ii. Choose the suitable sensor for the application and give the reason why you chose it.

(3 marks)

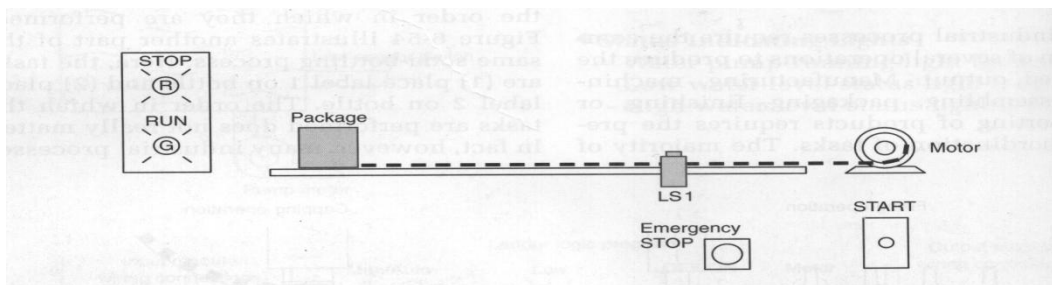


Figure 8: Conveyor system

Question 7

Consider a control circuit shown in **Figure 9**.

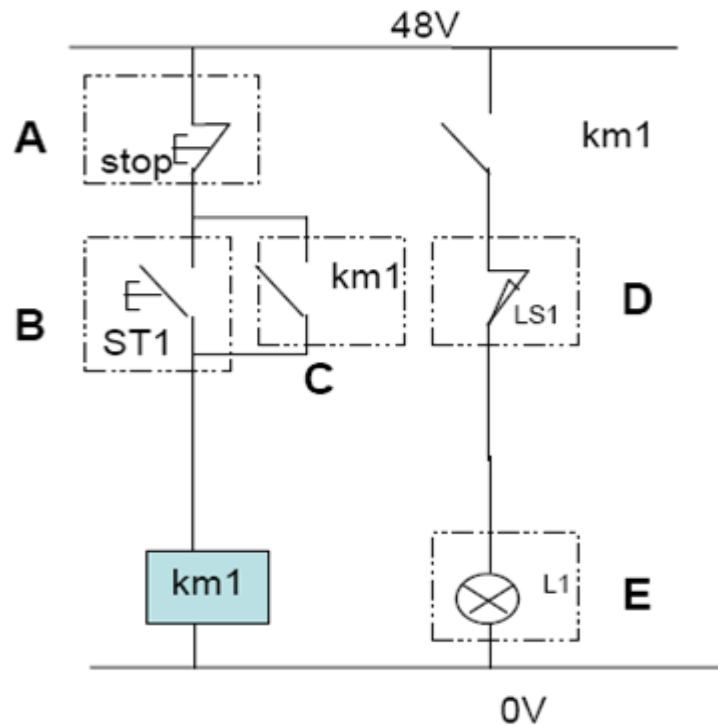


Figure 9: Schematic diagram of a simple control circuit

- (a) Name the components (A, B, C, D and E) (5 marks)

- (b) Explain in detail the functionality of this control circuit (5 marks)

- (c) Modify the control circuit in **Figure 9** by adding a yellow indicator light and another start button (ST2). The yellow indicator light shows that the power supply is ON and when one of the two start button is pressed (ST1 or ST2), the yellow light will OFF. **Note:** You are allowed to use as many as contactors and relays (10 marks)

END OF QUESTION