



**UNIVERSITI KUALA LUMPUR  
Malaysia France Institute**

---

**FINAL EXAMINATION  
JANUARY 2014 SESSION**

---

**SUBJECT CODE** : FAD 10003  
**SUBJECT TITLE** : AUTOMATION TECHNOLOGY  
**LEVEL** : DIPLOMA  
**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 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) Provide **one (1)** example of “Manual Repetitive” process that still exists nowadays. Suggest any “Mechanization” or “Automation” system that can replace such method. (3 marks)
- (b) Define Hardware and Software in automation field. (2 marks)
- (c) Draw the standard schematic symbol of below components: (3 marks)
- i. Limit switch
  - ii. Thermal Overload Relay
  - iii. Single acting cylinder
- (d) Give **two (2)** types of sensing element that are used in inductive and capacitive proximity sensor. (2 marks)
- (e) List **two (2)** advantages of using Sensing Distance Adjustment Potentiometer in photoelectric sensor. (2 marks)
- (f) Describe **three (3)** function of using an Operational Amplifier (Op Amp) in signal conditioning. (3 marks)

**Question 2**

- (a) The Programmable Logic Controller (PLC) incorporates with four (4) unit functions. State all **four (4)**. (4 marks)
- (b) Explain the operation of stepper motor and give **one (1)** example of its application. (3 marks)

(c) 3/2 way valve and 4/2 way valve is two examples of the directional control valve that act as a pneumatic pre-actuator. Answer below questions:-

i. Define pneumatic pre-actuator

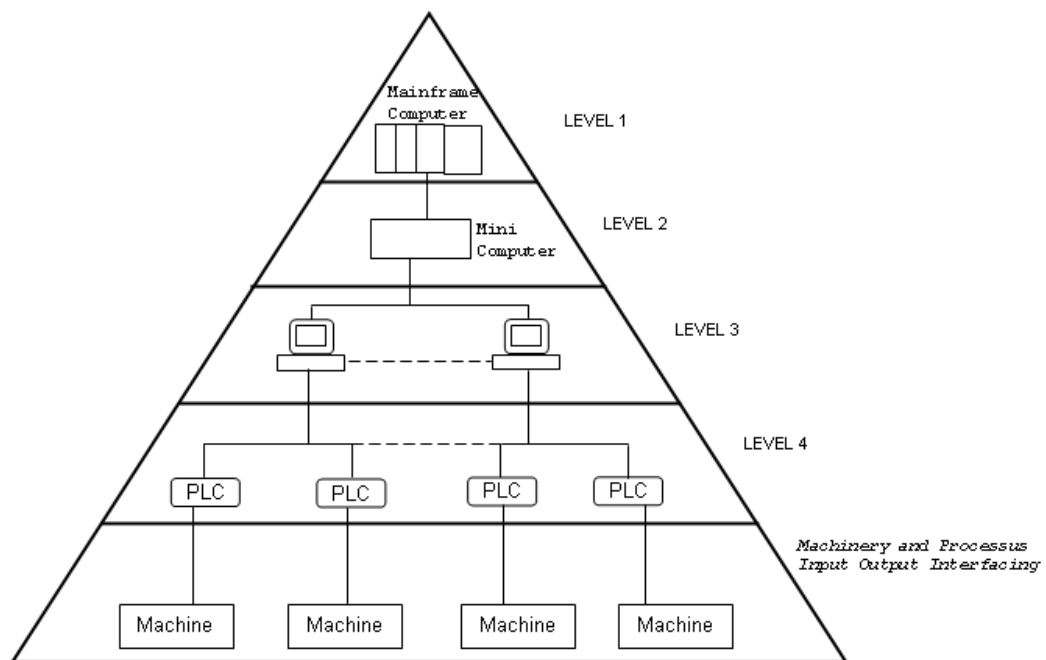
(2 marks)

ii. Draw the symbol for each type of the valve given.

(2 marks)

(d) A CIM comprises of level 1, 2, 3, and 4 as shown in **Figure 1**. Identify each level of hierarchy in a general automated factory.

(4 marks)



**Figure 1:** Hierarchy in an automated factory

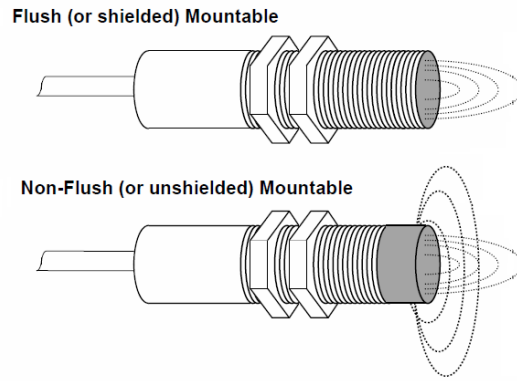
**Question 3**

(a) Explain the function of 'Normally Open' and 'Normally Closed' in limit switch.

(2 marks)

(b) **Figure 2** shows shielded and unshielded type of inductive proximity sensor. Identify the characteristic of actuation for both types and the mounting method.

(4 marks)



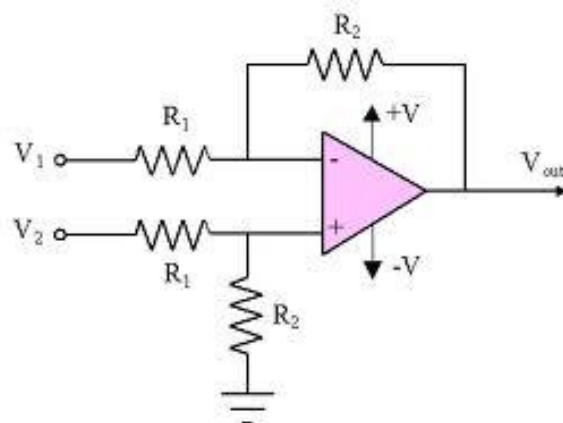
**Figure 2:** Inductive Proximity sensor

- (c) Describe the relationship between sensing distance and target thickness for nonferrous targets detection by proximity sensor.

(2 marks)

- (d) **Figure 3** shows a differential amplifier. Given input voltage,  $V_1 = 8.5V$  and  $V_2 = 2.5V$ . Calculate the output voltage when  $R_1 = 100k\Omega$  and  $R_2 = 700K\Omega$ .

(3 marks)



**Figure 3:** Differential Amplifier

- (e) State the function of RC High Pass Filter Circuit in **Figure 4**. Find the cut-off frequency  $f_c$  when  $R_1 = 250k\Omega$  and  $C_1 = 0.01\mu F$ .

(4 marks)

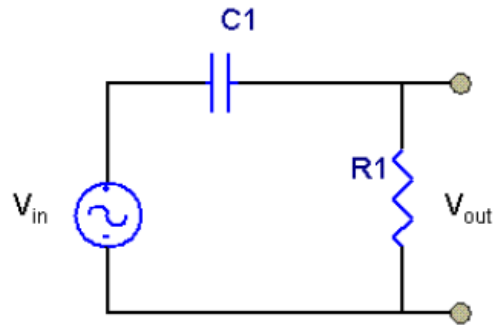


Figure 4: RC High Pass Filter

Question 4

(a) Complete the truth table in **Table 1** below by referring to logic circuit in **Figure 5**.

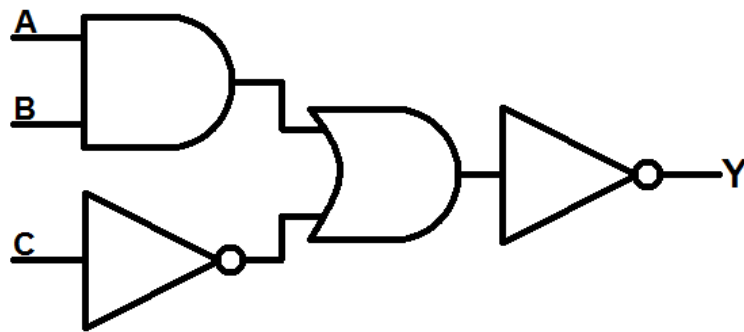


Figure 5: Logic circuit

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	

(12 marks)

- (b) Determine the resistance of a platinum RTD at 210°C if the resistance at 20°C is 125.5  $\Omega$  and if  $\alpha$  (20°C) = 0.00392.

(3 marks)

**SECTION B (Total: 40 marks)****INSTRUCTION: Answer TWO (2) questions only.****Please use the answer booklet provided.****Question 5**

- (a) **Figure 6** shows Wheatstone bridge application with a tank level transmitter system. A single float level sensor is used to measure the level of fuel.
- i. Level sensors generally can be divided into discrete type and analog type. State the difference between these two types. (2 marks)
  - ii. List **two (2)** types of analog level sensor that you know together with example material to be detected. (2 marks)
  - iii. Write the sequence on how calibration is being done for analog level sensor. (6 marks)
  - iv. Calculate the variable resistor value R3 when the bridge is at **null** condition. Given  $R1 = 375\Omega$ ,  $R2 = 250\Omega$  and  $R4 = 200\Omega$ . (3 marks)
  - v. The tank holds water with a depth of 9.0 ft. Find the pressure at the tank bottom in psi. (2 marks)

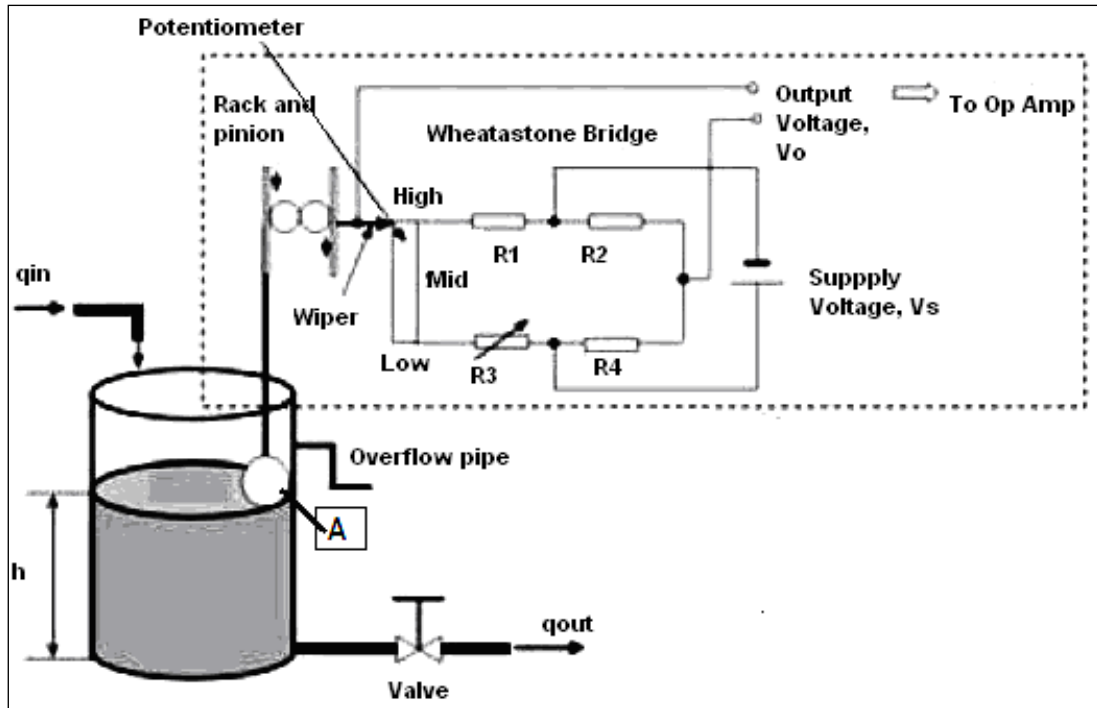
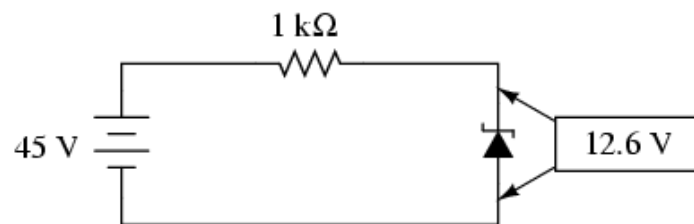


Figure 6: Tank Level System Control

- (b) Explain briefly how protection against high voltage in signal conditioning can be obtained by using Zener Diode circuit as exemplified in **Figure 7**.

(5 marks)



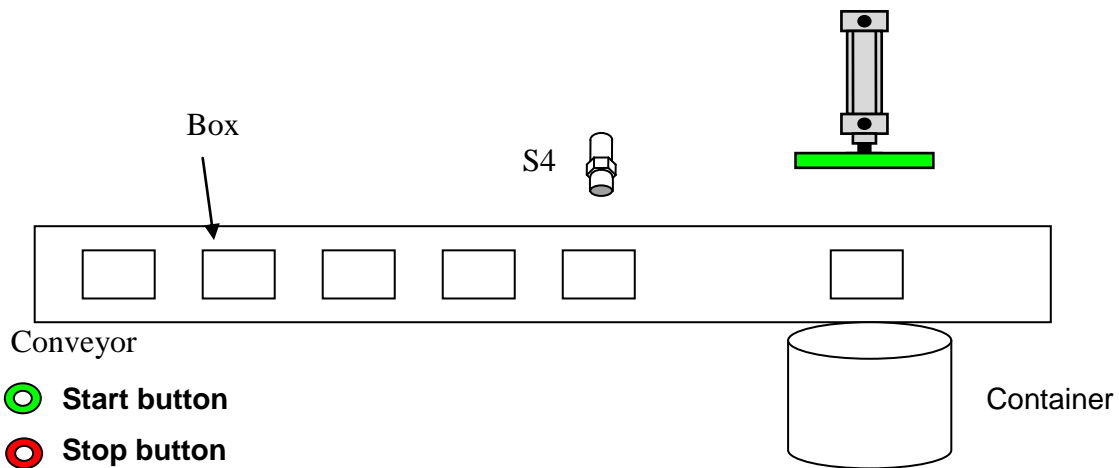
Diode  $V_{zener} = 12.6 \text{ V}$

Figure 7: Zener Diode circuit



**Question 6**

(b) **Figure 8** shows a part of recycle production system in company A. In this station, the arrival of metal boxes and paper boxes will be sorted out based on its material. The control power supply is 24VDC. When PB1 (START Push Button) is pressed, the main conveyor moves. Once sensor S4 detects paper box, pre-actuator V2 will actuate single acting cylinder to move the paper box into container while metal box will remain to the next station. Operation will stop when PB2 (STOP Push Button) is pressed. Answer the following questions.

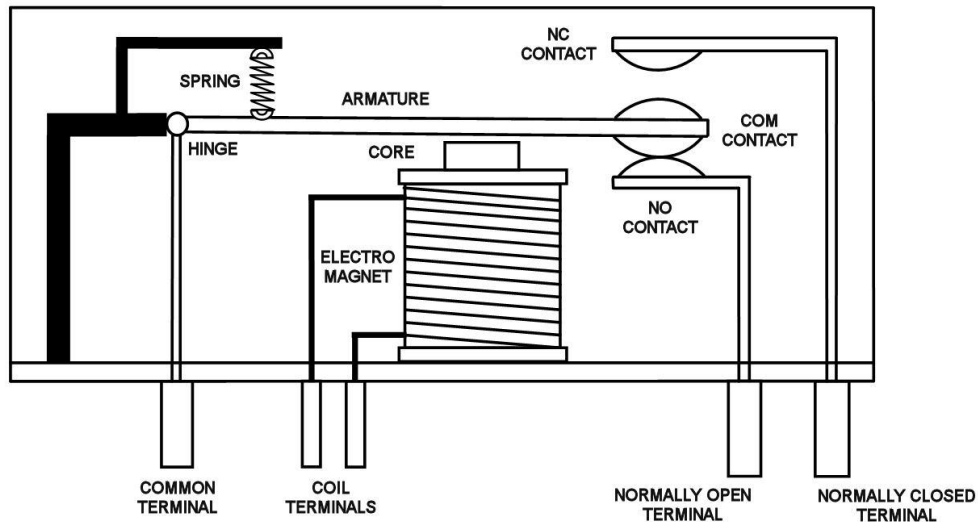


**Figure 8:** Box sorting system

- i. Determine the most suitable sensor for this system. Justify your answer. (3 marks)
- ii. Propose the suitable pre-actuator and controller that could be used in the system. (2 marks)
- iii. Construct the Control Circuit Diagram based on above explanation. (10 marks)
- iv. If the system is about to add a function to differentiate between metal boxes, paper boxes and PET bottle (with transparent characteristic), suggest the suitable sensor that can be added and the suitable actuator to enhance the sorting process from one position to multi-position. Justify your answer. (5 marks)

Question 7

- (a) **Figure 9** shows a relay as an electromechanical controller. Answer the following questions.



**Figure 9:** A construction of relay with normally open contact

- i. Describe the function of relay and its operation. (4 marks)
  - ii. List **two (2)** advantages of relay compared to electronic controller or programmable controller. (2 marks)
  - iii. With the involvement of relay, construct a control circuit diagram that present the “OR logic function” and “NOT logic function”. You may combine the circuit or illustrate them separately. (4 marks)
- (b) Provide the reason of introducing Computer Numerical Control (CNC) in manufacturing industries. (4 marks)
- (c) There are two types of CNC controller movement; Point to Point Movement and Continuous Path Movement. Discuss both of them. (4 marks)
- (d) Give **one (1)** type of CNC machine and its function. (2 marks)

**END OF QUESTION**