UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UCTATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BMT 2112
COURSE	: INTRODUCTION TO MECHATRONICS
SEMESTER/SESSION	: 1 - 2022/2023
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise up your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 10 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) Define the meaning of mechatronic system from your understanding.

(2 marks)

b) Describe two (2) advantages and disadvantages of mechatronic system

(4 marks)

c) The traffic light system is one of part mechatronic application. The system is based on the three basic colors used red, yellow and green to give the instructions. Regarding to the Figure 1, the starting color blinking for the system is **yellow** and followed by **red** and **green.** The time allotted for the color change are:

- *yellow to red (5s)*
- *red to green (10s)*
- *green to red (10s)*

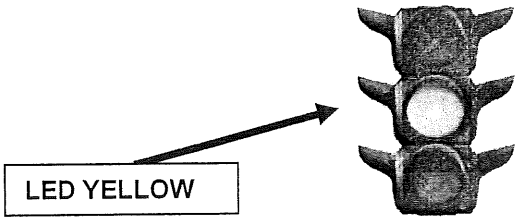


Figure 1

Based on the above-mentioned situation,

(i) Interpret the situation into mechatronic system model using the simple block box. (5 marks)

(ii) Illustrate the wiring diagram of the system using Arduino provided in ***Appendix A.*** (6 marks)

(iii) Produce the programming code to interpret the functionality of the above-mentioned situation using Arduino board. (8 marks)

QUESTION 2

a) Describe the meaning of the transducer. (2 marks)

b) Figure 2 shows a simple schematic circuit for fire alarm system.

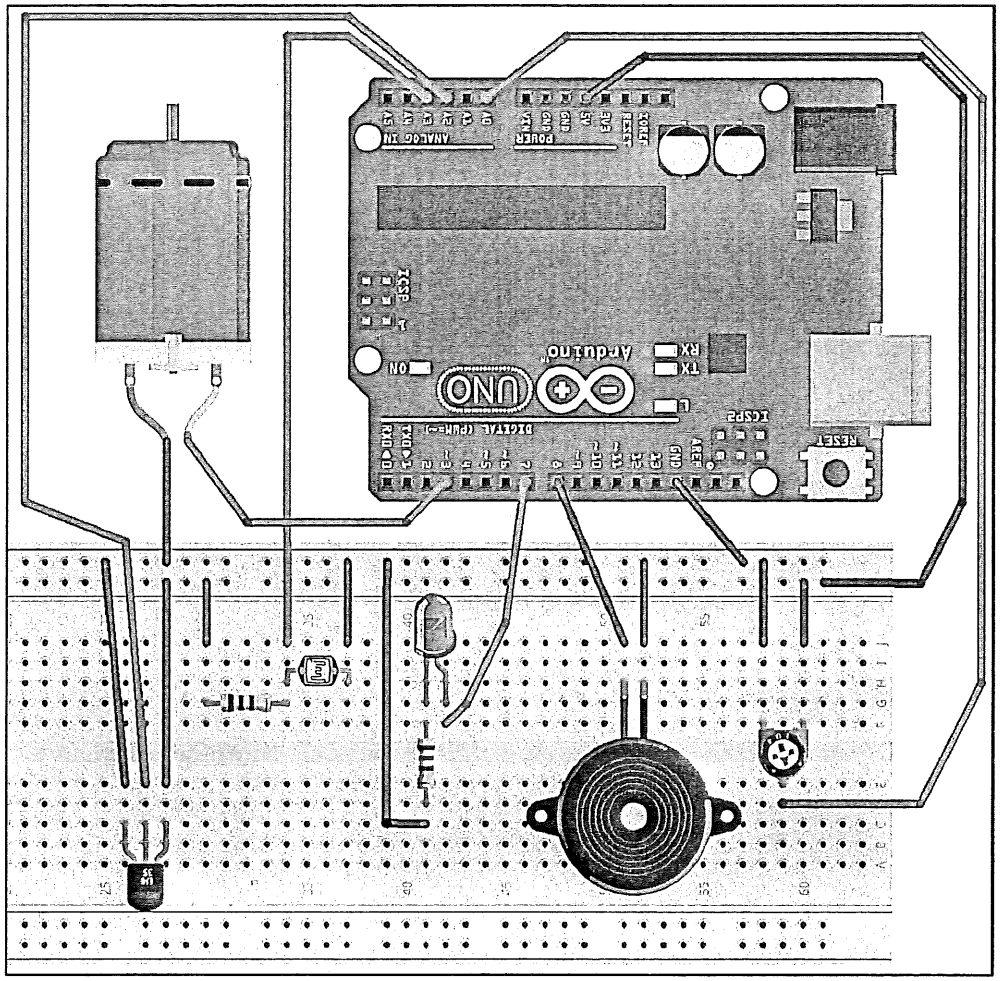


Figure 2

Based on the diagram in Figure 2,

(i) Name three (3) sensors used in the circuit. (3 marks)

(ii) Describe the function of the sensors used in (i). (6 marks)

c) Figure 3 shows the industrial robot.

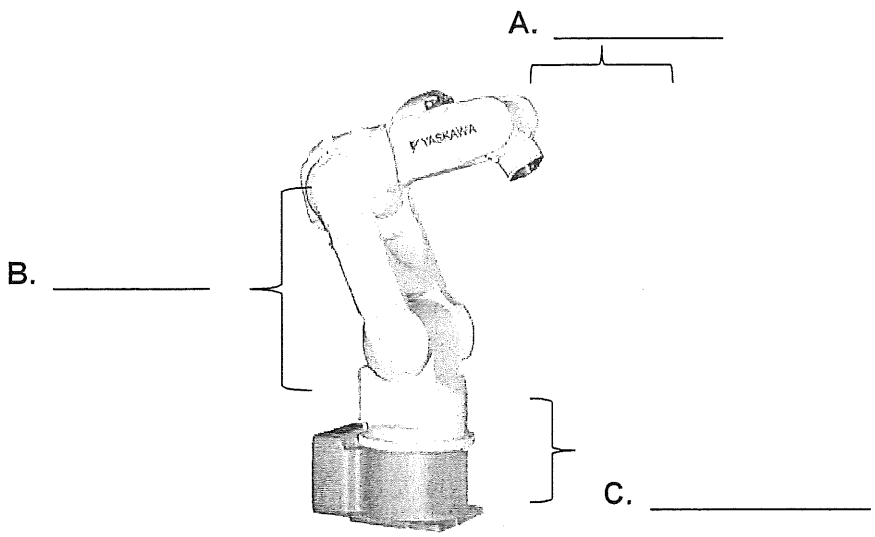


Figure 3

Based on this figure,

(i) Name the parts of the robot at **A, B** and **C.** (3 marks)

(ii) Describe the meaning of industrial robot. (2 marks)

(iii) Name three (3) types of 6-axis robotic arms similar to Figure 3. (3 marks)

(iv) State (6) applications of robotic arm in manufacturing process. (6 marks)

QUESTION 3

Table 1 shows the condition ON/OFF of the Lamps (12V DC) when triggered by pushbuttons.

Table 1

Condition of Input Pushbutton (PB1 & PB2)	Condition of Output	
	LAMP 1	LAMP 2
Both pushbuttons (Pressed)		
PB1 (pressed)		
PB2 (pressed)		
Both pushbuttons (released)		
 ON	 OFF	

Based on the conditions in Table 1,

a) List the quantities of each component needed. (2 marks)

b) Describe the condition of input and output. (3 marks)

c) Illustrate the wiring diagram of the system using Arduino provided in ***Appendix B.*** (6 marks)

d) Draw the flowchart for the conditions in Table 1. (5 marks)

e) Produce the programming code which can turn ON/OFF Lamp 1 and Lamp 2 (12V DC) according to the condition stated in Table 1. (9 marks)

QUESTION 4

Table 2 shows the state of the DC Motor (12V DC) when adjusted with a potentiometer and the results are shown in Figure 4.

Table 2

Input (Potentiometer reading) in voltage (V)	Output	
	DC Motor 1	DC Motor 2
0 – 2.49V	ON	OFF
2.5V – 5V	OFF	ON

Virtual Terminal

```
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
PERCENTAGE= 50% VOLTAGE= 2.50V MOTOR 2 IS ON
```

Figure 4: Virtual Terminal Output

a) Describe two (2) functions of the potentiometer used for this situation. (3 marks)

b) Illustrate the wiring diagram by connecting the DC Motor (12V DC) and other components with the Arduino board as provided in ***Appendix C***. (6 marks)

c) Produce the programming code which can turn ON/OFF DC Motors (12V DC) according to the condition stated in Table 2. (10 marks)

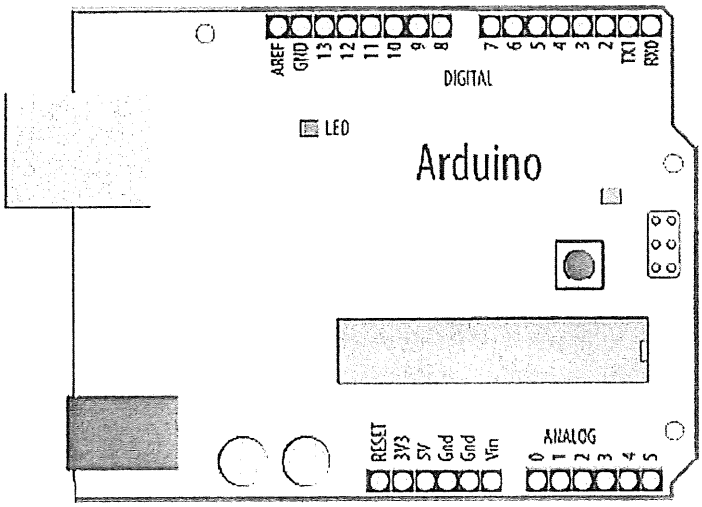
d) Identify the results of DC motor in Table 3. (6 marks)

Table 3

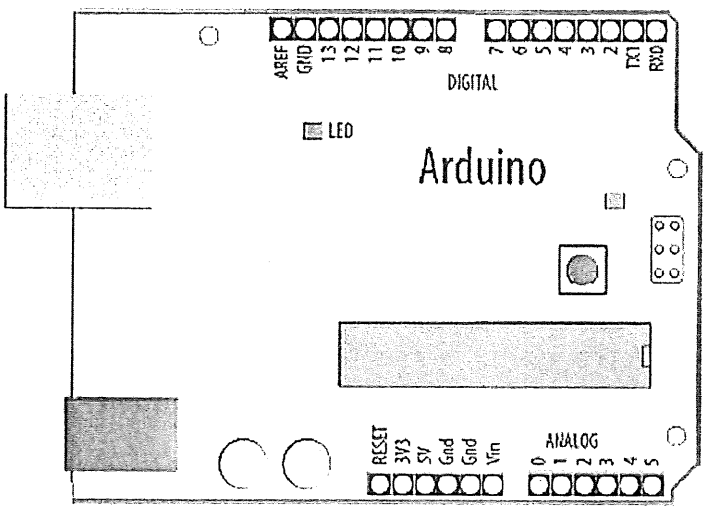
Input	Output in digital value	
Potentiometer (%)	DC Motor 1	DC Motor 2
15%		
64%		
45%		
28%		
72%		
85%		

----------End of question----------

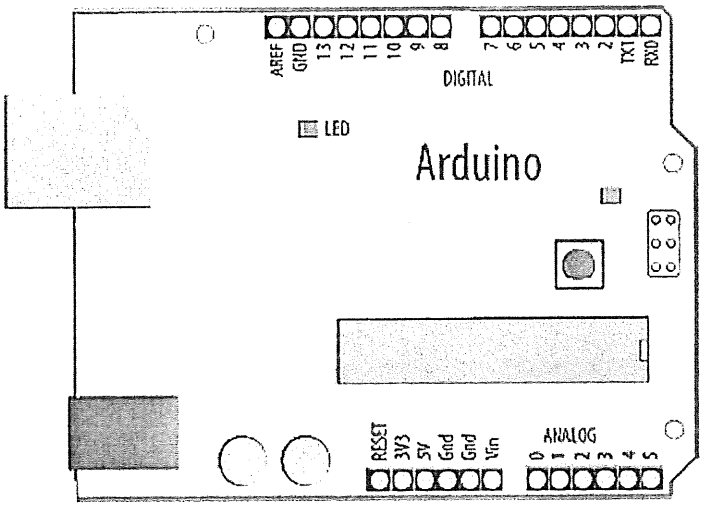
Appendix A


AREF
GND
13
12
11
10
9
8
7
6
5
4
3
2
TX1
RX0
DIGITAL
LED
Arduino
RESET
3V3
5V
Gnd
Gnd
Vin
ANALOG
0
1
2
3
4
5

Appendix B


AREF
GND
13
12
11
10
9
8
7
6
5
4
3
2
TX1
RX0
DIGITAL
LED
Arduino
RESET
3V3
5V
Gnd
Gnd
Vin
ANALOG
0
1
2
3
4
5

Appendix C


AREF
GND
13
12
11
10
9
8
7
6
5
4
3
2
TX1
RX0
DIGITAL
LED
Arduino
RESET
3V3
5V
Gnd
Gnd
Vin
ANALOG
0
1
2
3
4
5