



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013**

COURSE NAME : **INDUSTRIAL ELECTRONICS**
COURSE CODE : **DAE 32003**
PROGRAMME : **3 DAE/DAL**
EXAMINATION DATE : **MARCH 2013**
DURATION : **2 ½ HOURS**
INSTRUCTIONS : **ANSWER FOUR (4)
QUESTIONS ONLY**

THIS QUESTION PAPER CONSISTS OF SIXTEEN (16) PAGES

Q1 (a) Give similarity between solenoid and relay.

(3 marks)

(b) Based on Figure Q1(b):

- (i) Explain the operation during de-energize and energize state.
- (ii) State the functions of 15A fuse in the system.
- (iii) What type of relay is shown in Figure Q1 (b).
- (iv) Give four different components could be used as coil transient suppression across point 1 and point 2 and specify it's purposed.

(14 marks)

- (c) (i) Give two methods for improvement of solenoid construction.
- (ii) With the help of diagram, explain one of the methods for improvement of solenoid construction.

(8 marks)

Q2 (a) Figure Q2(a)(i) shows the control circuit for a packaging machine. The control circuit is used to detect and count the number of products being carried out on an assembly line. When it counts five products, the circuit energizes a solenoid. The solenoid is energized for a period of two seconds and is then shut off, causing it to retract.

- (i) Fill in A, B and C from the ladder diagram in Figure Q2(a)(ii) with the proper elements and addresses.
- (ii) Based on Q2(a)(i), write the mnemonic code for the system.

(7 marks)

(b) Figure Q2(b) shows the mnemonic code for a car park system. Draw the ladder diagram for that particular mnemonic code.

(12 marks)

(c) Figure Q2(c) shows the ladder diagram for two (2) lamps control. Explain the condition of Lamp 1 and Lamp 2. Briefly explain:

- (i) Condition 1: All the buttons are pushed.
- (ii) Condition 2: All the buttons are not pushed.
- (iii) Condition 3: Push button C fail to function (normally open) and push button B is pushed.

(6 marks)

Q3 (a) Figure Q3(a)(i) and Table Q3 shows three (3) cylinders system controlled by a main single start button (PB) and three (3) conditional sensors; A, B and C. The process sequence is shown as below.

- All cylinders are in retract position during initial position except for cylinder B that in extend position.(Refer Figure Q3(a)(i) diagram)
- Start button is pressed.
- Cylinder B retracts.
- Sensor B detects full retraction for Cylinder B.
- After 3 secs, cylinder A extends.
- Sensor A detects maximum extension for cylinder A.
- After 4 secs, cylinder C extends.
- All system RESET/OFF when sensor C detected maximum extension for cylinder C.

Based on the process sequence above:

- (i) Draw a pneumatic diagram for cylinder B only (During De-Energized and Energized state).
- (ii) Based from the ladder diagram in Figure Q3(a)(ii), what is the elements that need to be place at A,B,C,D and E in order for the system to function properly.

(21 marks)

(b) Figure Q3(b) shows an example of a ladder diagram using timer.

- (i) State type of ladder it is?
- (ii) If the ladder in Figure Q3(b) is modified where A is placed with 0.00 input normally close (NC) contact, what type of ladder will it be?

(4 marks)

Q4 (a) Figure Q4(a)(i) shows the game buzzer control system and Table Q4(a) shows the IO assignment. The requirement are as follows:

- After the host had finished with the question, the 3 players will press the switch in front of them to fight to be first to answer the question.
- The buzzer will sound for 10 seconds after any one of the player has touched the switch.
- The light indicator in front of each player will light up and only reset by host switch.

From ladder diagram in Figure Q4(a)(ii), please fill in the box from A to E with appropriate elements and addresses.

(13 marks)

- (b) Figure Q4(b)(i) and Table Q4(b) shows the PLC used to start and stop the motors of a segmented conveyor belt. This allows only conveyor segment carrying an object to move. The position of an object is detected by a proximity sensor located next to each conveyor segment. As long as the object is within the detecting range of the proximity sensor in each conveyor segment, that particular motor will work. If the object moves beyond the range, a timer is activated for 2 seconds and the motor of that conveyor segment will stop.
- The operation is as follows:

- Motor 3 will always on.
- Motor 2 turns on when sensor 3 detects the object.
- Motor 2 is on until Motor 1 is turned on and the object is out of detection range of sensor 2.
- Motor 1 turns on when sensor 2 detect the object.
- Motor 1 is on until object is out of detection range of sensor 1.

From ladder diagram in Figure Q4(b)(ii), please fill in the box from A to E with appropriate elements and addresses.

(12 marks)

- Q5** (a) Consider the integrator circuit in Figure Q5(a). The input signal, V_i to the circuit is a 20kHz square wave with 3Vp-p.
- (i) Sketch and label the values of the output signal, V_o .
 - (ii) Calculate the frequencies where the circuit will stop acting as an integrator.
 - (iii) Sketch the output signal, V_o when it is not acting as an integrator and what kind of circuit it is acting now.

(15 marks)

- (b) From Figure Q5(b), all value R and V are stated as below:
 $R_1=2k\Omega$, $R_2=6k\Omega$, $R_3 =5k\Omega$, $R_4=4k\Omega$, $R_5=8k\Omega$, $R_6=15 k\Omega$, $R_7=10k\Omega$,
 $V_1=1 V$, $V_2=2 V$.

- (i) Name types of Op Amp from the circuit.
 (ii) Find the value for V_3 , V_4 and V_5

(10 marks)

- Q6** (a) Figure Q6(a) shows one type of solenoid valve. State the type of the valve?

(3 marks)

- (b) Figure Q6(b)(i) is a symbol for a valve.
 (i) Based from Figure Q6(b)(i), describe the operation of the valve when the solenoid is energized and deenergized.
 (ii) What does the symbol in Figure Q6(b)(ii) represent ?

(10 marks)

- (c) A conveyor system works as follows :

A start button is used to turn on a conveyor belt A that brings bottles to a filling station. Sensor S1 placed at the centre of conveyor A will stop the conveyor belt A upon detecting the bottle. Here a valve will open for 2 seconds for filling liquid into the bottle. After that the conveyor will move again until the bottle is sensed by sensor S2 at the end of the conveyor. Conveyor A will stop again and a solenoid is energized for 3 seconds for a piston to push the bottle onto conveyor belt B. The process is repeated for other bottles until a stop switch is pressed.

- (i) List out the input and output devices for this system.
 (ii) Draw a grafcet or sequence function chart for this problem.

(12 marks)

- END OF QUESTION -

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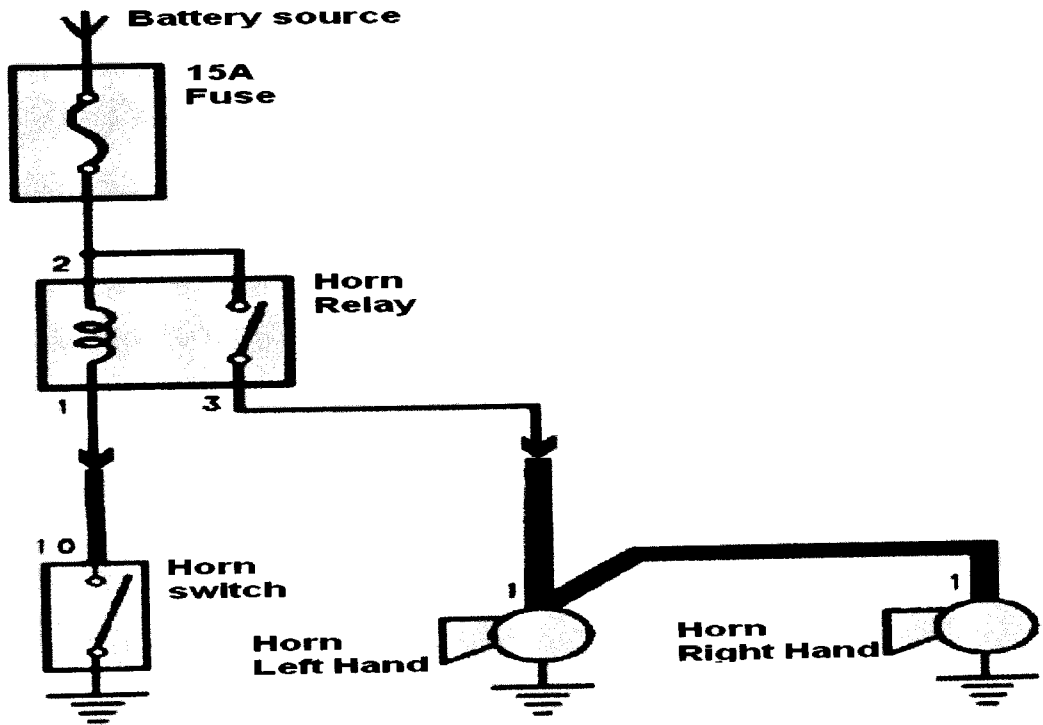
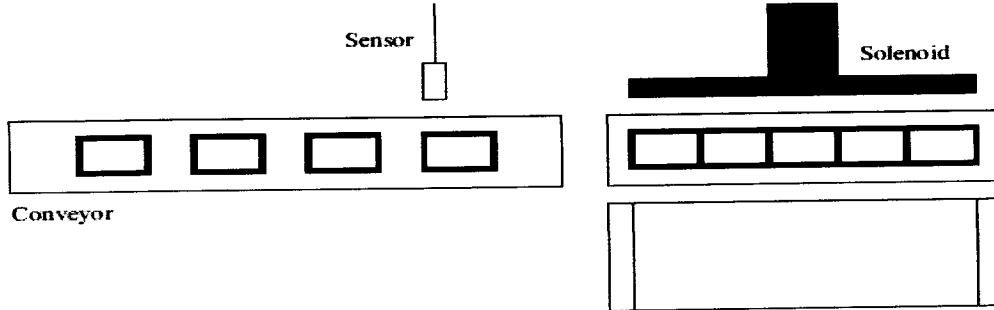


FIGURE Q1(b)

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Input	Device
00000	Sensor

Output	Device
01000	Conveyor
01001	Solenoid

Others	
CNT 047	Product counter
TIM 000	Solenoid energizer timer

FIGURE Q2(a)(i)

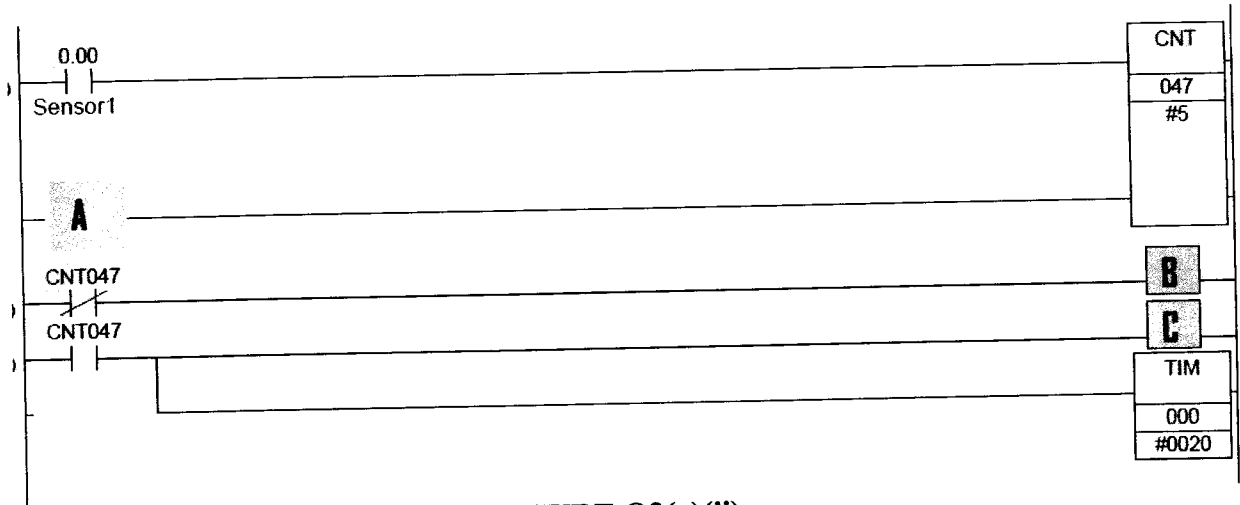


FIGURE Q2(a)(ii)

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Address	Instruction	Data
0000	LD	0.00
0001	DIFU(13)	HR1.01
0002	LD	0.01
0003	DIFD(14)	HR1.02
0004	LD	HR1.01
0005	ADD(30)	HR0
		#1
		HR0
0006	LD	HR1.02
0007	SUB(31)	HR0
		#1
		HR0
0008	LD	P On
0009	CMP(20)	#30
		HR0
0010	AND	P EQ
0011	OUT	100.00
0012	END	

FIGURE Q2(b)

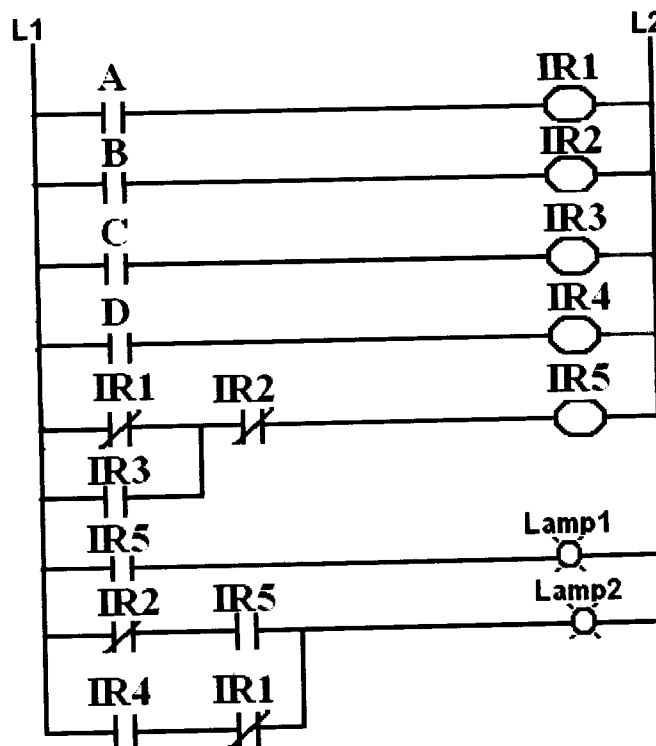


FIGURE Q2(c)

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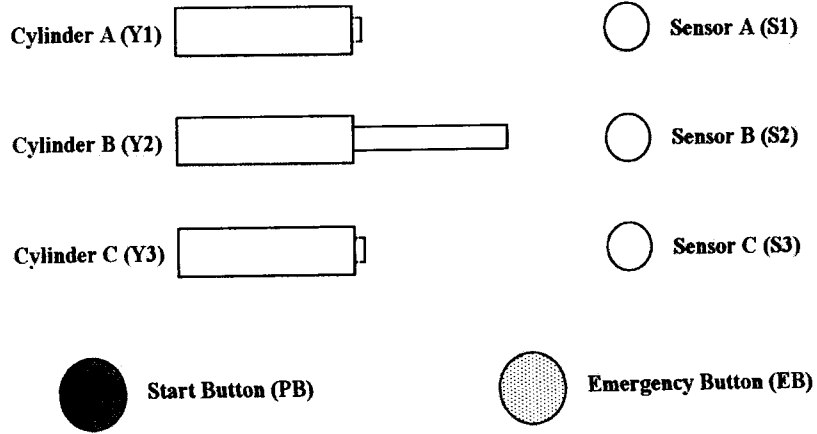


FIGURE Q3(a)(i)

TABLE Q3

Item	Symbols	Description	Initial State
Cylinder A	Y1	Single Acting (3/2 Way Valve)	NC
Cylinder B	Y2	Single Acting (3/2 Way Valve)	NO
Cylinder C	Y3	Single Acting (3/2 Way Valve)	NC
Start Button	PB	Single Pole Spring Return	NO
Sensor A	S1	Limit Switch w/o latching	NO
Sensor B	S2	Limit Switch w/o latching	NO
Sensor C	S3	Limit Switch w/o latching	NO

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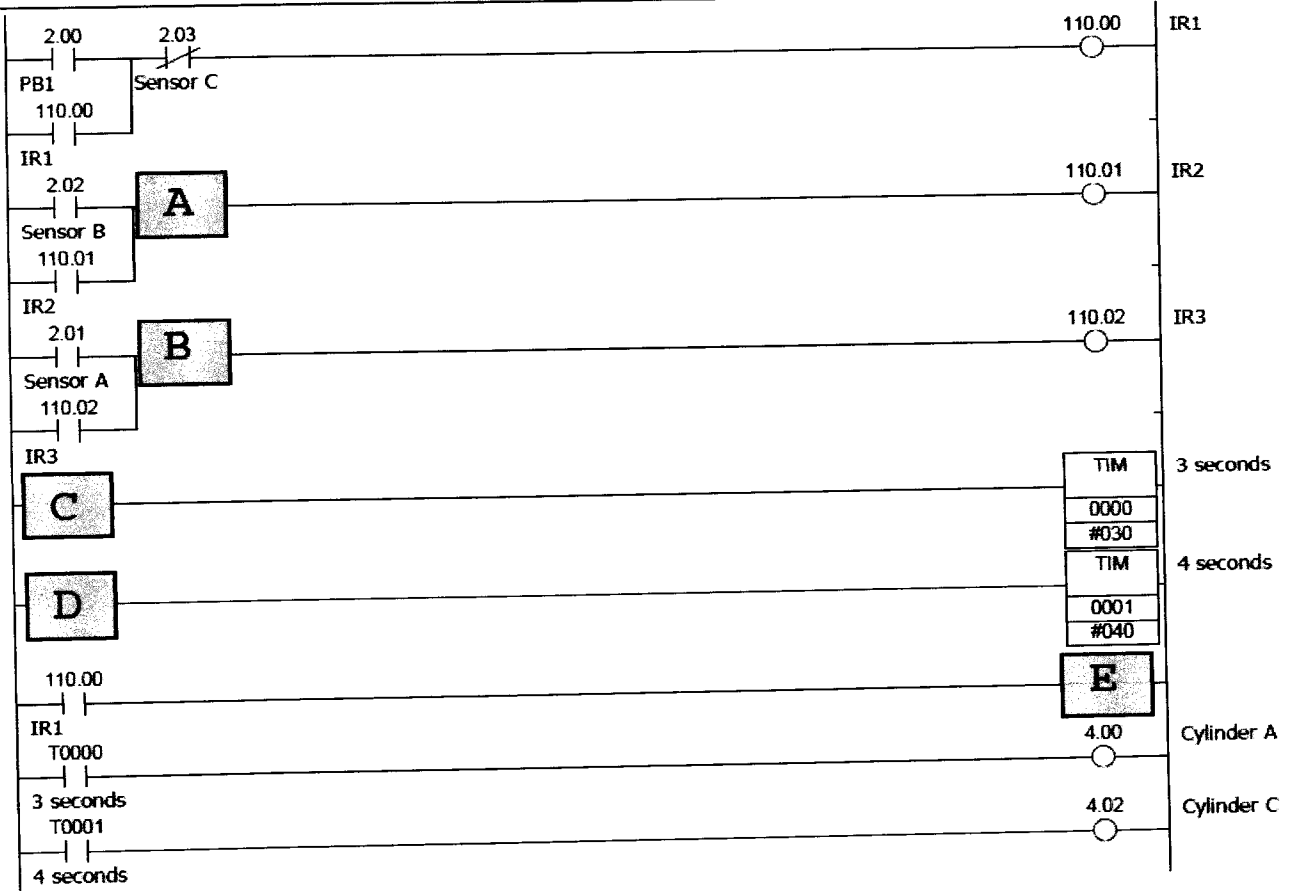


FIGURE Q3(a)(ii)

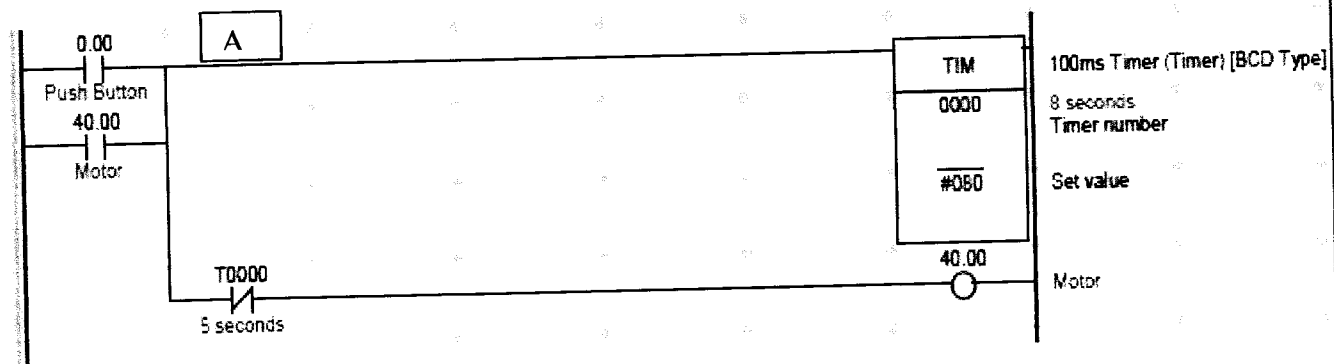


FIGURE Q3(b)

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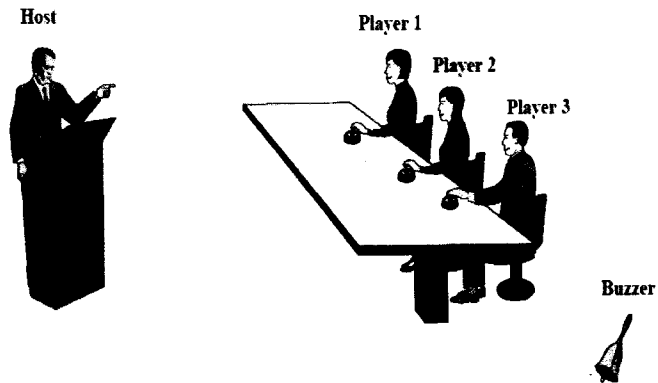


FIGURE Q4(a)(i)

TABLE Q4(a)

Input	Device
00000	PB1
00001	PB2
00002	PB3
00003	RST (reset)

Output	Device
01000	Buzzer
01001	Player 1 light
01002	Player 2 light
01003	Player 3 light

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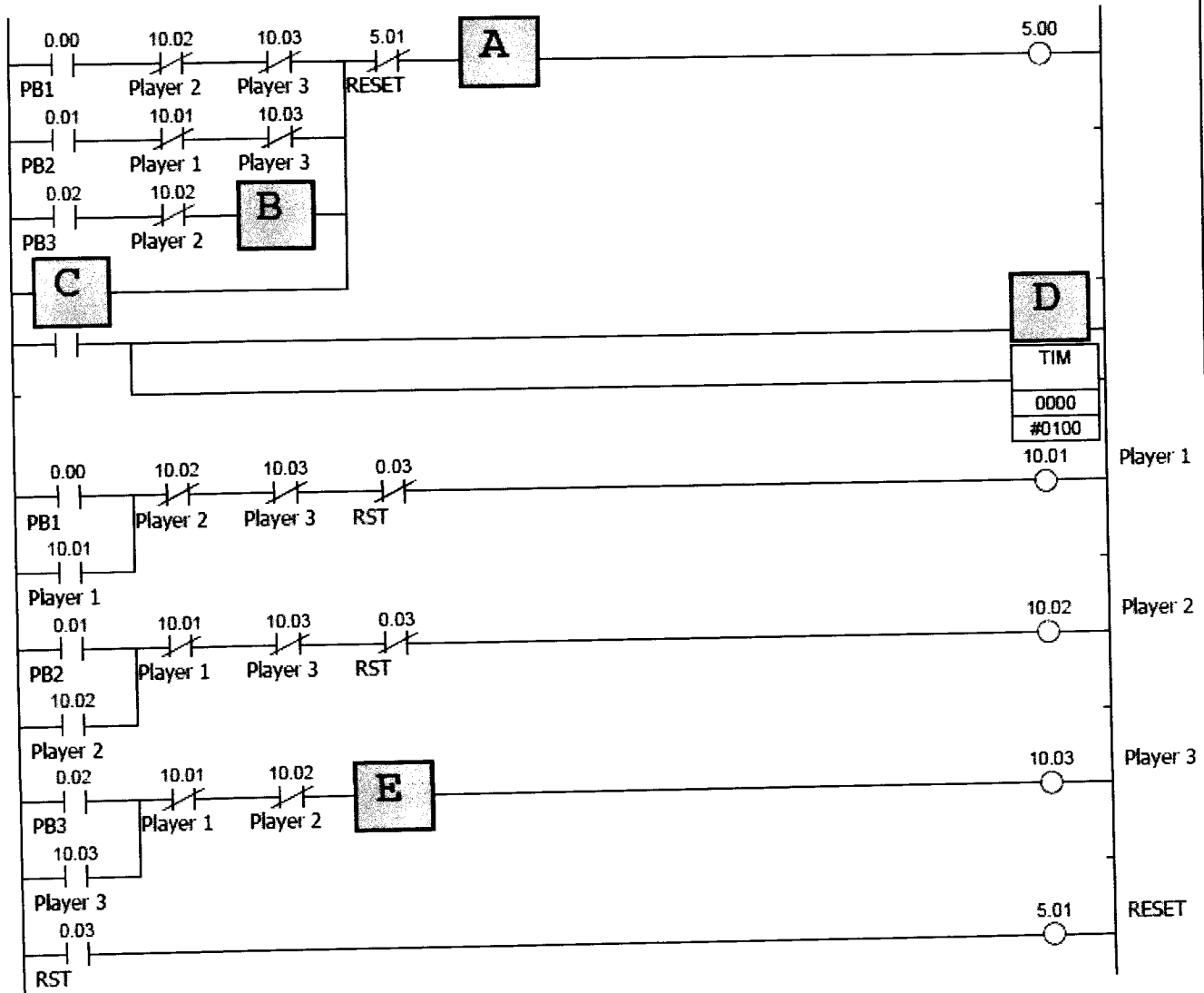


FIGURE Q4(a)(ii)

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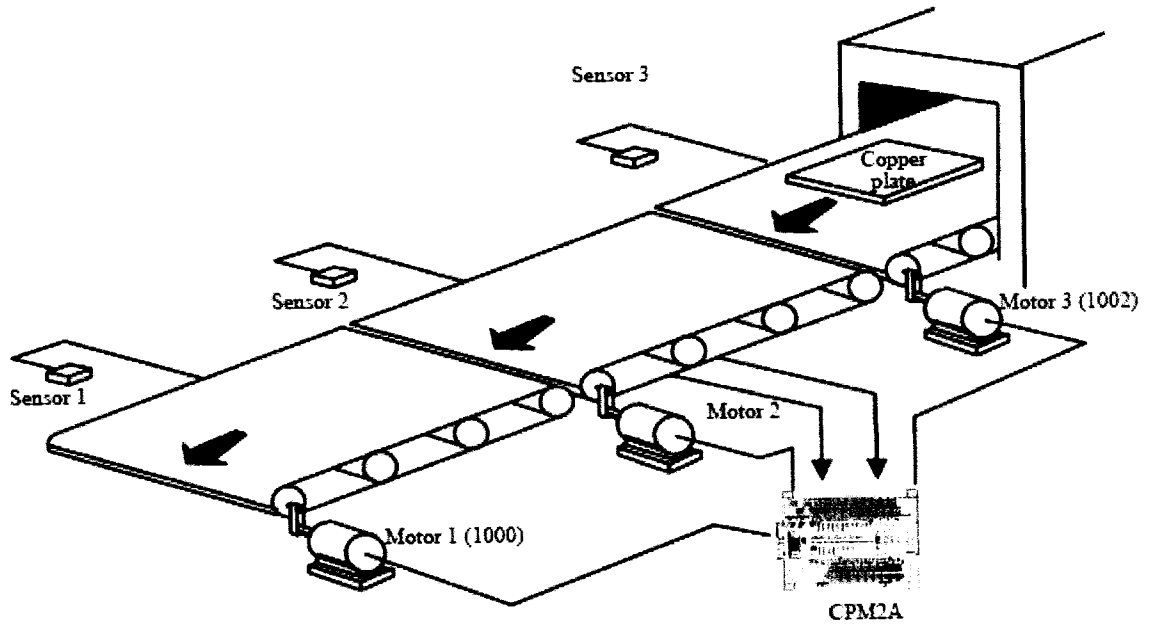


FIGURE Q4(b)(i)

TABLE Q4(b)

Input	Devices
0000	Sensor 1
0001	Sensor 2
0002	Sensor 3

Output	Devices
0100	Motor 1
0101	Motor 2
0102	Motor 3

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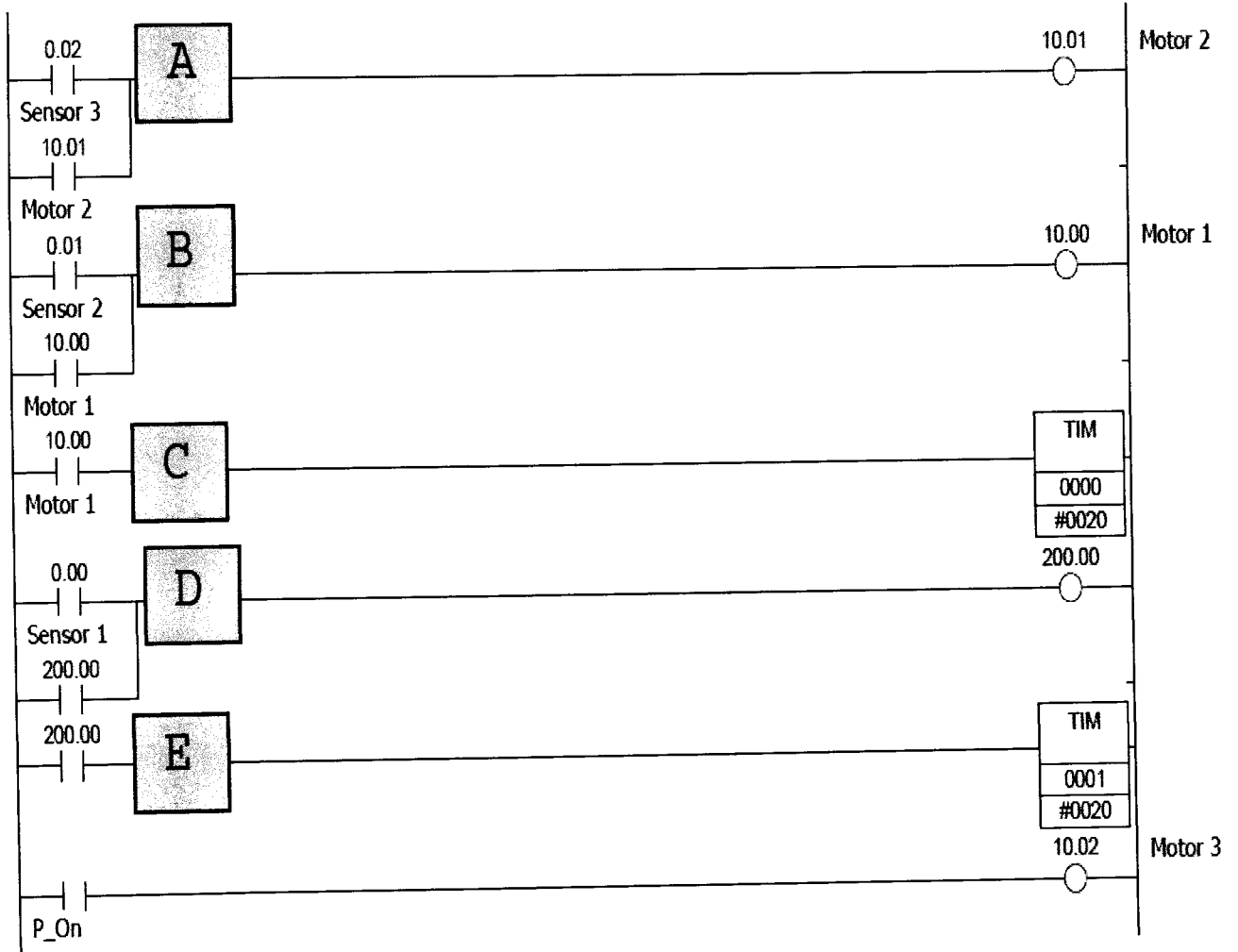


FIGURE Q4(b)(ii)

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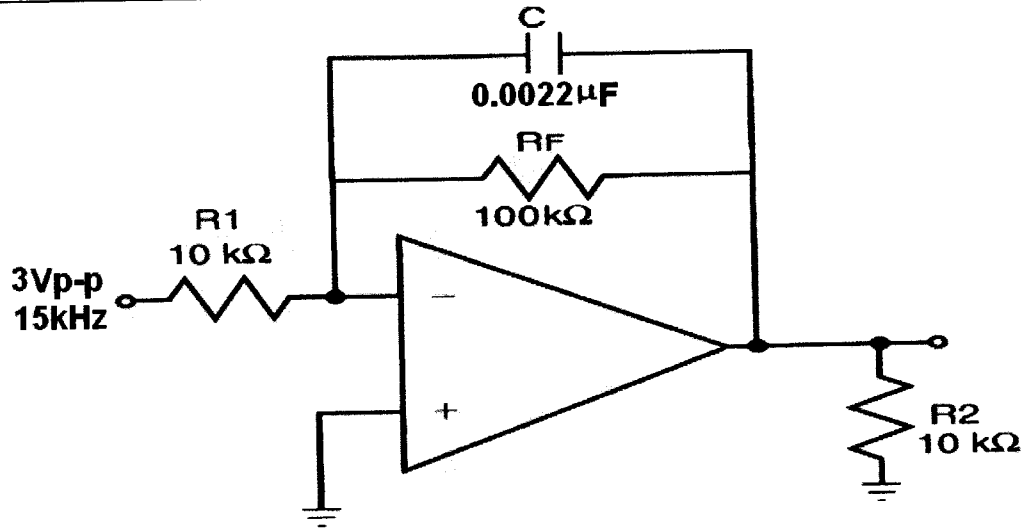


FIGURE Q5(a)

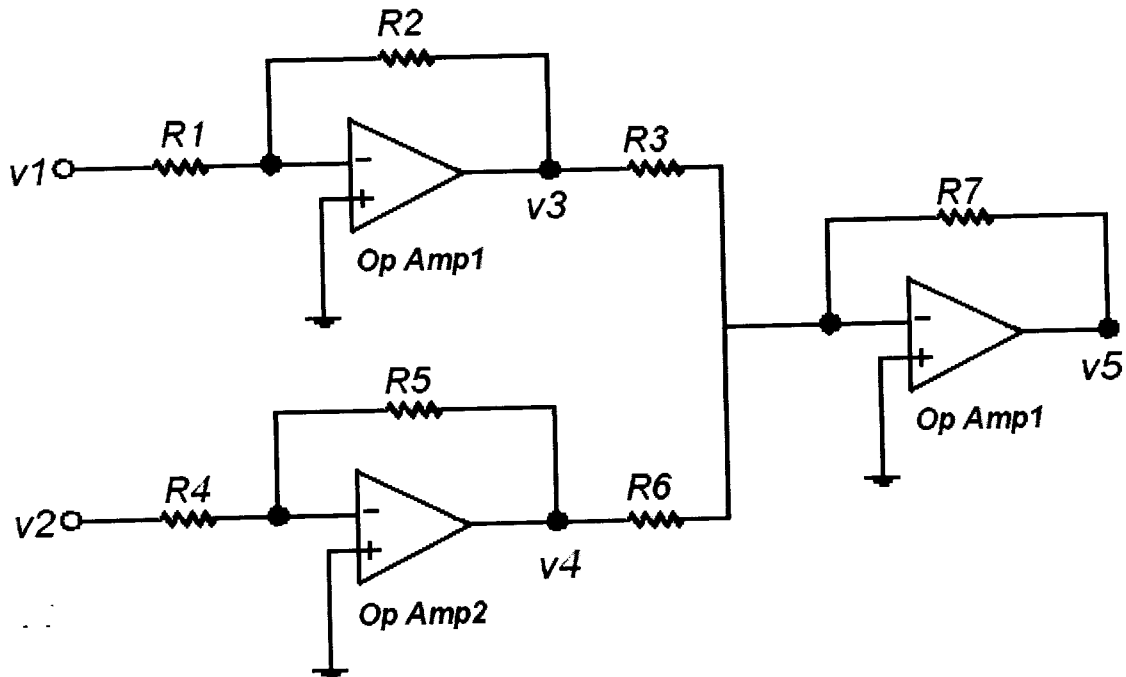


FIGURE Q5(b)

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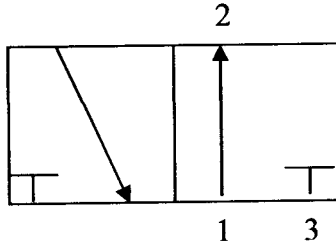


FIGURE Q6(a)

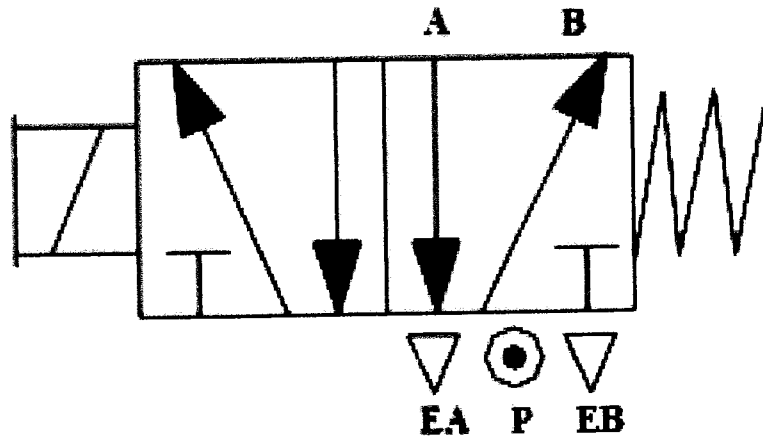


FIGURE Q6(b)(i)

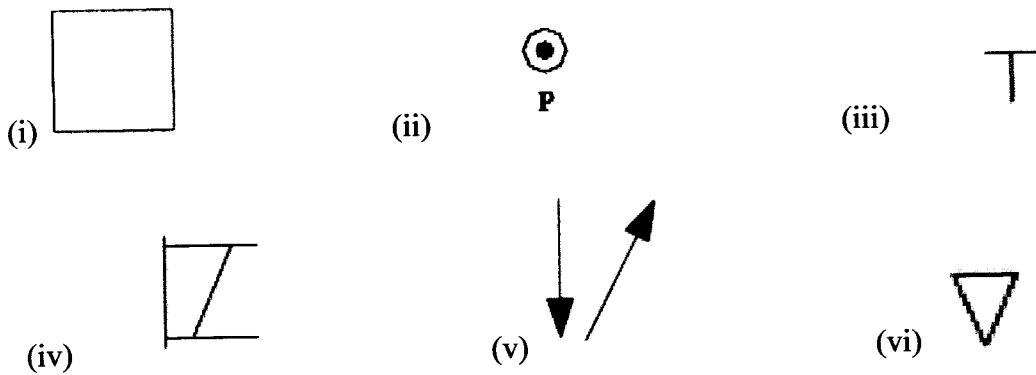


FIGURE Q6(b)(ii)