UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2010/2011

COURSE NAME	:	INDUSTRIAL ELECTRONICS
COURSE CODE	:	DEK 3113
PROGRAMME	:	3 DEE/DET
EXAMINATION DATE	:	NOVEMBER/DECEMBER 2010
DURATION	:	2 1/2 HOURS
INSTRUCTIONS	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF ELEVEN (11) PAGES

Q1. (a) State three advantages of using electromechanical relay.

(3 marks)

(b) Based on Figure Q1(b):

(i) Explain the operation of Figure Q1 (b) during de-energized and energized state when pin 2 and pin 4 is connected to a lamp.

(4 marks)

(c) There are two types of solenoid.

(i) List the two types of solenoid

(2 marks)

(ii) Explain the difference between these two solenoid (with the aid of simple drawing showing their energized state)

(5 marks)

(d) (i) One of the weaknesses of AC solenoid is when the AC current drop to zero. Explain this weakness and state the method used solve this problem.

(5 marks)

(e) Figure Q1 (e) show a ladder diagram of a system. Write the mnemonic function of the system.

(6 marks)

Q2. (a) Figure Q2(a) shows a cutter which is used to cut the side edge of the paper in a printing firm. This cutter is controlled by pneumatic single acting cylinder. For the safety of the operator, the cutter will move down only when the both Push Button switched, PB1 and PB2 are pressed and safety cover is closed. This safety cover is closed manually(by operator) and Limit Switch, LS1 is used to detect the closed position. When one of the Push Button is released and safety cover is opened, the cutter will immediately move to its top position. Draw an electric diagram for the above condition.

(7 marks)

(b) Figure Q2(b) shows how 3 Axis Robot move the load from original position (shown in the figure) to Box B. There are only 3 sensors available which are up sensor, right sensor and left sensor. The process flow of moving the load is shown below:

Process flow:

Push Button is pressed → Move down → Grip the load → Move up → Move to the right → Move down → Move to the front → Ungrip the load

It uses 3 different cylinders:

Cylinder A - Double Acting Cylinder (3/2 way valve normally close):
Move down (Y1) and move up robot arm.

Cylinder B - Single Acting Cylinder (3/2 way valve normally close):
Grip (activate Y2) and ungrip the load.

Cylinder C - Single Acting Cylinder (3/2 way valve normally close):
Move to the right (activate Y3) and move to the left robot arm.

Cylinder D - Single Acting Cylinder (3/2 way valve normally close):
Move to the front (activate Y4) and move to the back robot arm.

Use the following assumption:

(1) Time for robot arm to move from up position to down position (or vice versa) is 2 sec.
(2) Time for robot gripper to grip/ungrip the "Load" is 0.5 sec.
(3) Time for robot arm to move from right position to left position (vice versa) is 2 sec.
(4) Time for robot arm to move from back position to front position (vice versa) is 1 sec.

Based on Figure Q2(b):

(i) Draw a grafset diagram for the application.
(4 marks)

(ii) Draw the displacement diagram for cylinder A,B, C and D. Please include all traveling time in your diagram
(4 marks)

(iii) Draw the electric diagram
(10 marks)

Q3. Figure Q3 shows the grafset diagram for the Conveyor Belt's operation.

(a) Develop a ladder diagram and mnemonic code by using the given indicator and CQM1H instruction which are KEEP and CNTR.

(12 marks)

(b) Develop ladder diagram using CQM1H instruction:
(i) ADD and SUB instruction to replace CNTR
(ii) MOV to replace Reset
(iii)KEEP to replace 'latch'

Use CQM1H instruction and following address

Input: 00000 – 00015
Output: 10000 – 10015
25313 – always on
25505 – (>)
25506 – (=)
25507 – (<)
Internal relay: 04000 – 04999
Holding relay: H000 – H055

(13 marks)

Q4. (a) Figure Q4(a) show the integrator amplifier. Proved that Vo(t) for the integrator is as below:

$$Vo(t) = -\frac{1}{RC}\int Vi(t)\,dt$$

(7 marks)

(b) The values for all the resistors in Figure Q4(b) are stated below:

R1 = 10Ω , R2 = 100Ω , R3 = 100Ω , R4 = 10Ω, R5 = 10kΩ , R6 = 100kΩ , R7 = 1kΩ ,

(i) Name each of the Op Amp circuit in Figure Q4(b) and state its function.

(3marks)

(ii) Find the values for V_{01}, V_{02} and V_{out}

(15 marks)

Q5. (a) What is the difference between duty cycles of 25%, 50%, 75% and 100% in terms of the speed of the motor with a 10V signal voltage.

(8 marks)

(b) List out three methods used to control the speed of a DC motor.

(3 marks)

(c) Sketch and explain in detail how the Full Bridge circuit shown in Figure Q5(c) make the motor moved:

(i) Forward
(ii) Backward

(14 marks)

Q6. (a) There are basically three (3) types of stepping motors, discuss only two (2) of stepper motor types in terms of their construction; based on the use of permanent magnets and/or iron rotors with laminated steel stators.

(10 marks)

(b) Explain the difference between full step and half step of a stepper motor. Please include operation diagram for each answer

(11 marks)

(c) Calculate the resolution of 4-phase hybrid stepper motor of 3.6 ° step if it operates in:

(i) full step
(ii) half step

(4 marks)

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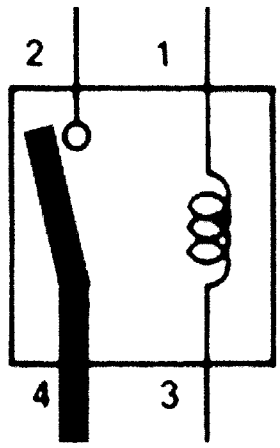

FIGURE Q1(b)

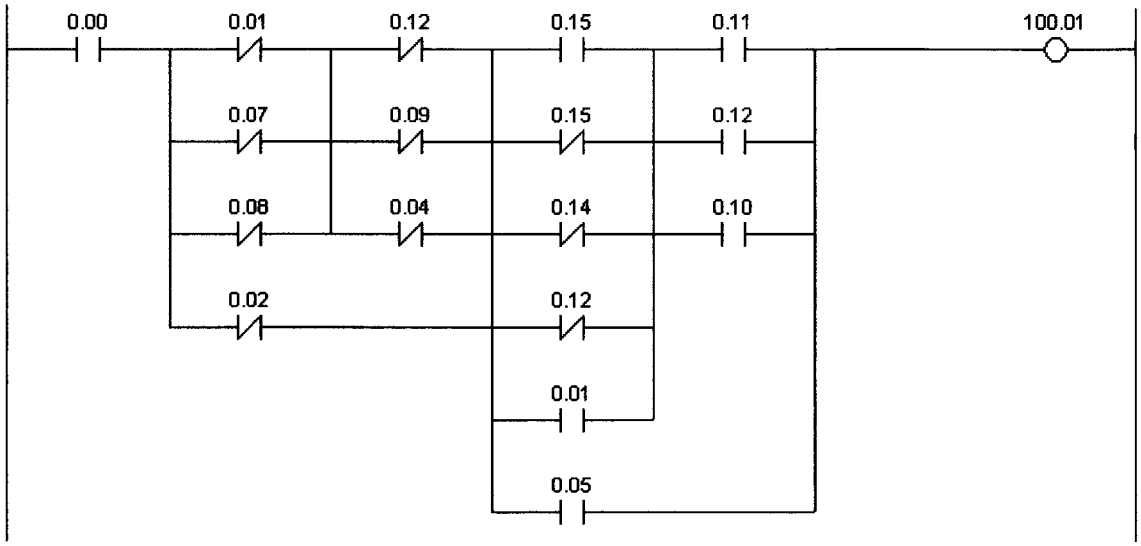

FIGURE Q1(e)

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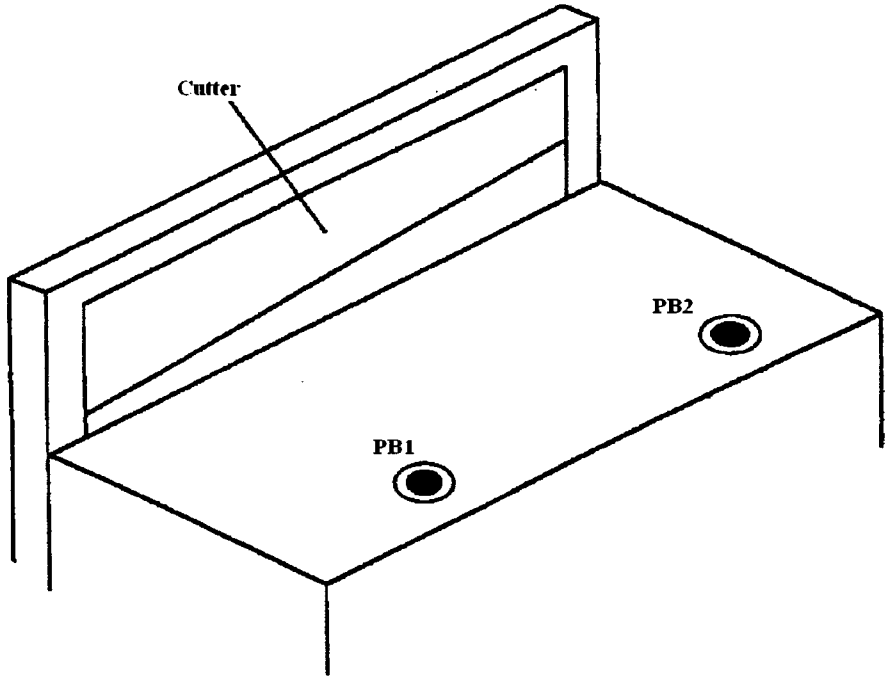

FIGURE Q2(a)

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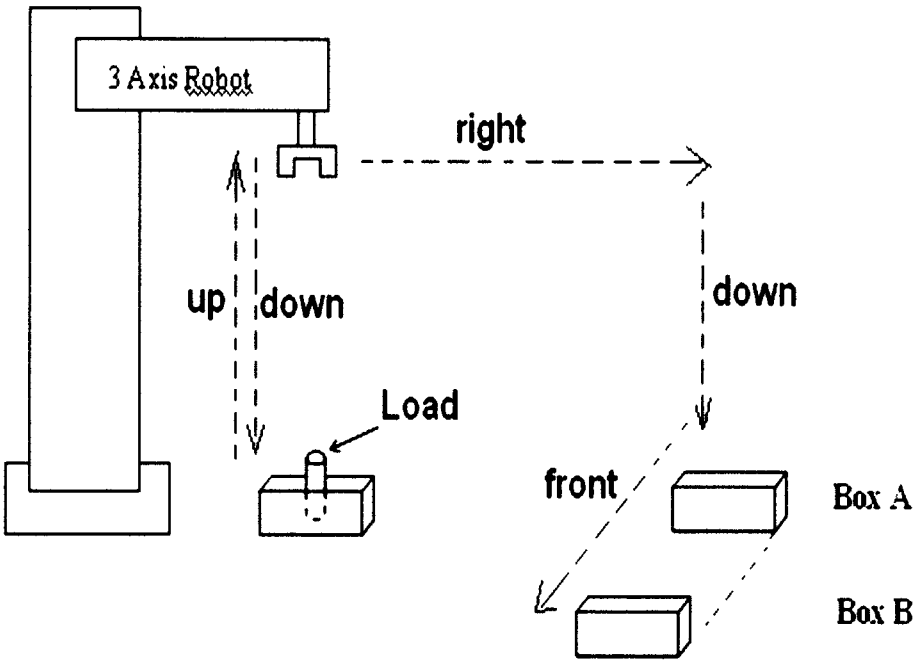

Figure Q2(b)

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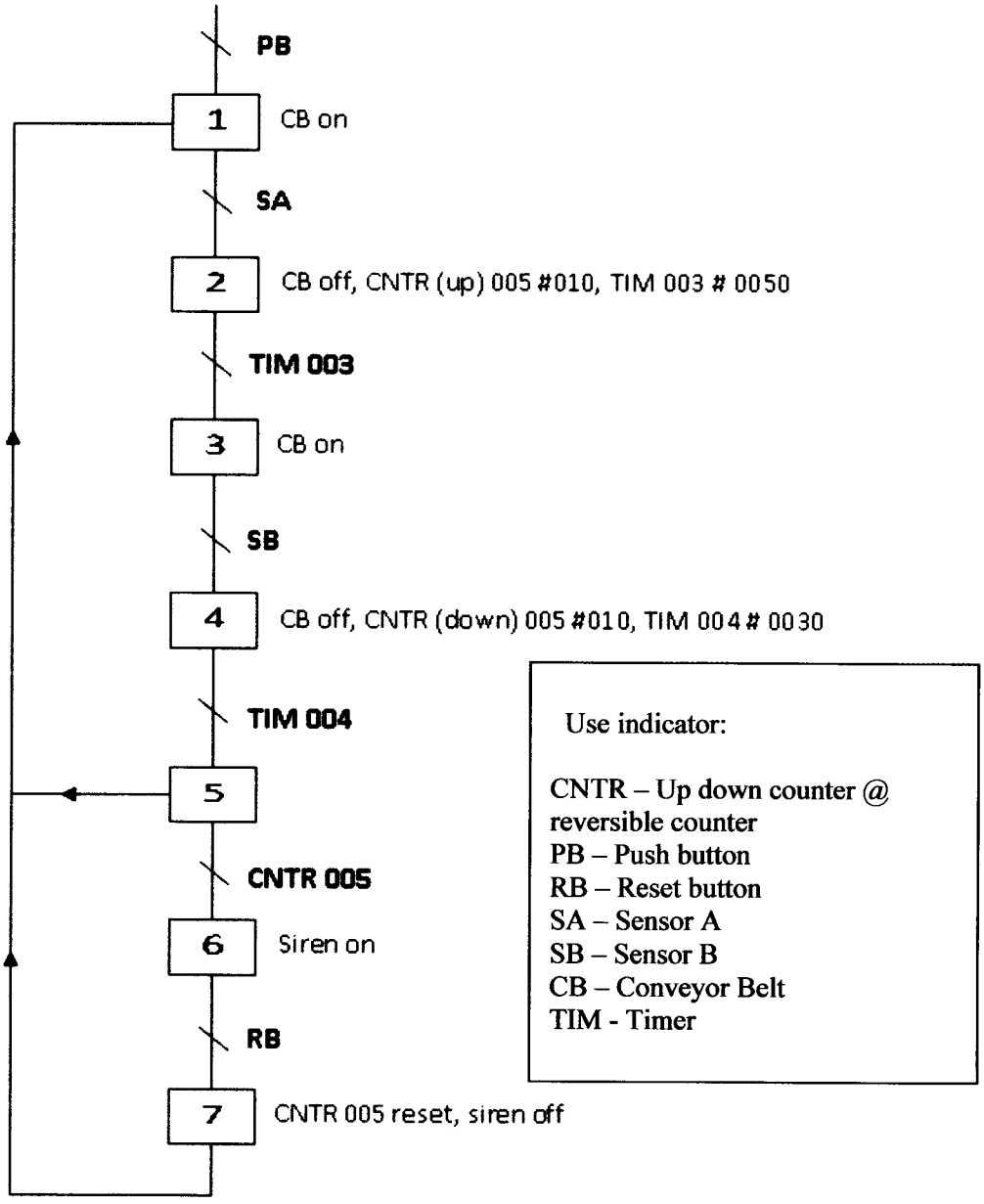

FIGURE Q3

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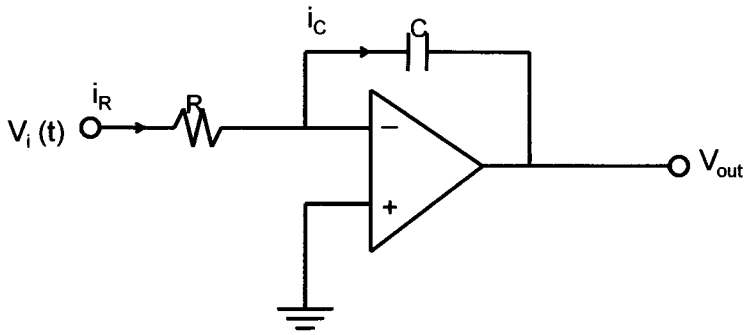

FIGURE Q4(a)

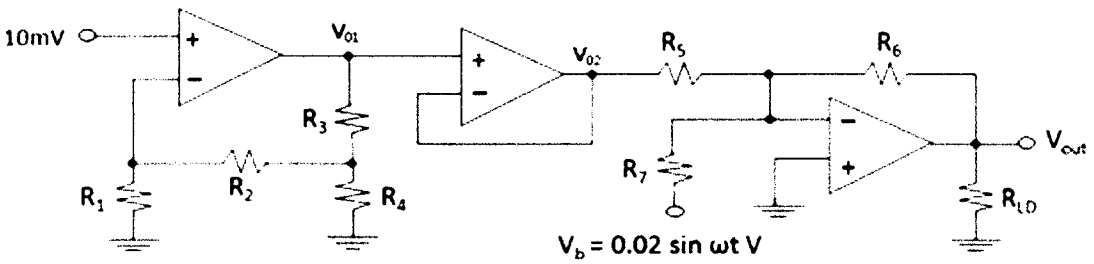

FIGURE Q4(b)

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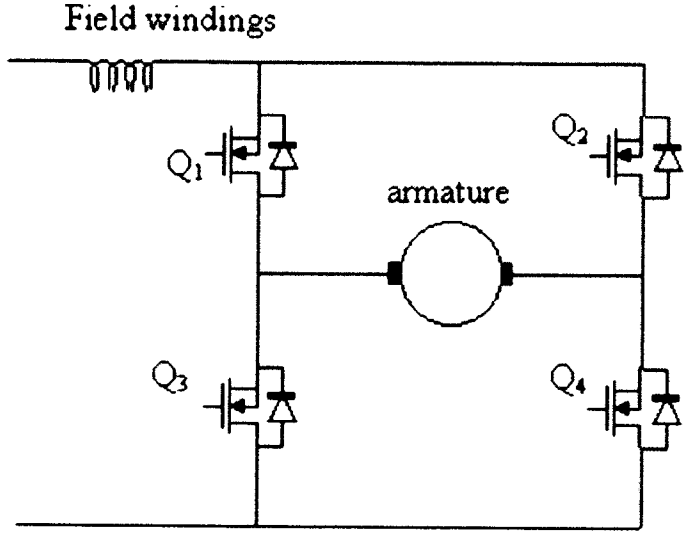

Figure Q5(c)