Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017

COURSE NAME	:	INDUSTRIAL ELECTRONIC
COURSE CODE	:	BND 30603
PROGRAMME CODE	:	3BND
EXAMINATION DATE	:	DECEMBER 2016 / JANUARY 2017
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWERS **FOUR (4)** QUESTIONS ONLY

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THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) **Figure Q1(a)** shows a summing amplifier circuit:

(i) Show that

$$Vo = -\left(V1\frac{RF}{R1} + V2\frac{RF}{R2}\right)$$

Any diagram involved must be clearly and neatly shown.

(4 marks)

(ii) This summing amplifier is to be modified as a level shifter with V1= +/-1.0V being the audio signal to be shifted to the input range of an ADC which is 0 to +2V. The shifting can be achieved by introducing DC offset utilizing V2 and R2. Given that V2= -5V and R1 is 10 kΩ, calculate the value of RF and R2.

(4 marks)

(b) **Figure Q1(b)** shows a phase angle controller circuit for an AC load. By analyzing and plotting the waveforms formed at points A, B, C, D, E and F, describe clearly the working of the circuit at each designated point starting from point A and ends at point F. For the sake of uniformity, assume the delay angle to be 60°.

(17 marks)

Q2 (a) **Figure Q2(a)** shows part of the ladder diagram of a process. Convert the ladder diagram into mnemonic codes.

(7 marks)

(b) **Figure Q2(b)** shows the ladder diagram of a car park control system and it allows parking space of 100 cars only. Everytime a car comes in, the PLC will automatically add one to the counter through sensor S1 placed near the entrance. Any car goes out from the car park will automatically result in the subtraction of one from the counter through sensor S2 placed near the exit. When 100 cars are registered, the 'CAR PARK FULL' sign will be lighted up to inform oncoming vehicles not to enter. Having understood the function of the ladder diagram, you are required to convert it into mnemonic codes.

(18 marks)

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Q3 **Figure Q3** shows the power circuit and the control circuit of a star-delta starting scheme. The electromechanical control circuit needs to be replaced with a PLC unit with essential accessories. To do that the following need to be performed :

(a) Reproduce the control circuit and then identify the real inputs and outputs by circling each I/O element

(5 marks)

(b) Assign the I/O addresses, assuming input memory location starting at 0000 till 0007 while output memory location starting at 0300 to 0307

(7 marks)

(c) Assign the internal addresses (if required), assuming internal register location starts at 1000 till 1007.

(3 marks)

(d) Draw the I/O connection diagram and the ladder diagram when a PLC is used.

(10 marks)

Q4 A double acting cylinder shown in **Figure Q4** is used to perform to and fro operation with positions of starting and ending marked by sensors S1 and S2 respectively. The piston will move forward when PB1 button is pressed and continue to and fro motion till 10 cycles of operations is performed. The whole cycle will be repeated when PB1 is pressed again. However the process can be interrupted at any time when the stop pushbutton PB2 is pressed. You are required to design a pneumatic control circuit incorporating with the use of PLC. It is recommended that a 5/2 way doubled solenoid valve is to be used in conjunction with the cylinder. You may need to pick a memory device and a counter or other accessories for this design:

(a) List out the main components/parts/equipment for this design

(3 marks)

(b) Draw and label the pneumatic diagram

(4 marks)

(c) Draw the PLC I/O wiring diagram

(4 marks)

(d) Draw the PLC program ladder diagram to implement this task

(10 marks)

(e) Based on your design briefly explain the working of the design when PB1 is pressed

(4 marks)

Note: To facilitate uniformity and ease of identification, you may use I1, I2, .. and O1, O2.. for your PLC I/O reference and other appropriate coding in the ladder diagram.

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Q5 The opening and closing of a door is controlled by using a double acting cylinder. The opening of the door is activated by pressing a push button switch PB1. When PB1 is pressed, the door is open (piston starts to extend). Limit switch LS1 will detect the full extention of piston (door is fully open). The door remains open for 10 seconds and after which it is automatically closed.

You are asked to design the project by using a 5/2 way directional valve and assume the traveling time for piston from original position to full extension and vice versa to be 1.0 second duration. For future reference you are asked to produce the following documentation:

(a) To list out input and output components involved (3 marks)

(b) Draw the grafcet (3 marks)

(c) Draw the motion Diagram (3 marks)

(d) Draw the displacement diagram (3 marks)

(e) Draw the pneumatic circuit connection (8 marks)

(f) Draw the electric control diagram (5 marks)

-END OF QUESTIONS –

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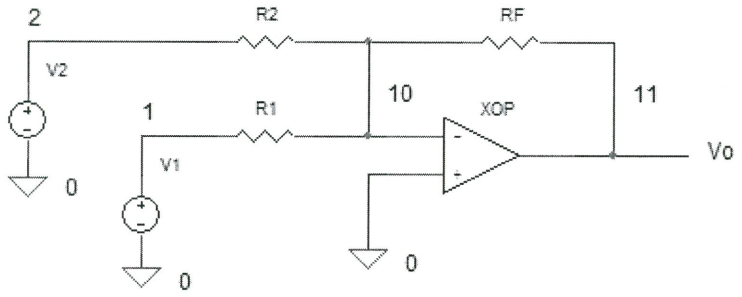

Figure Q1(a)

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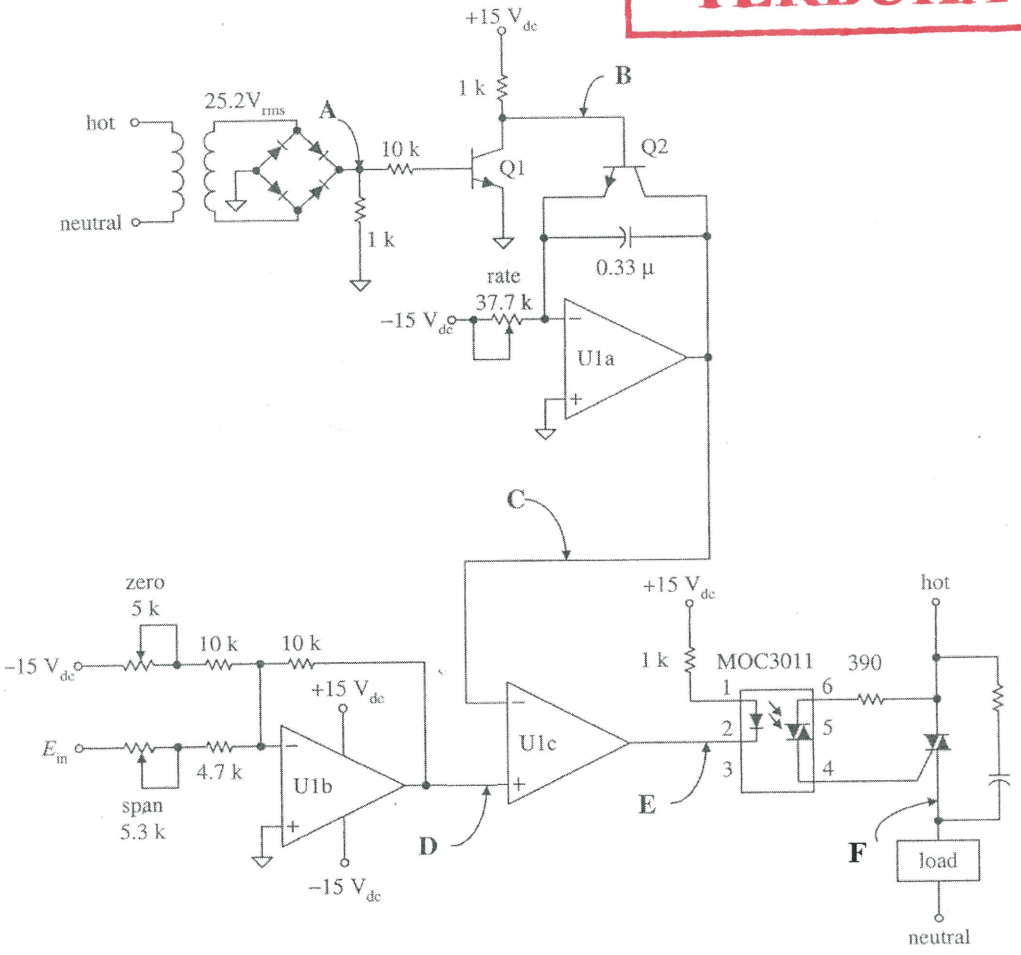

Figure Q1(b)

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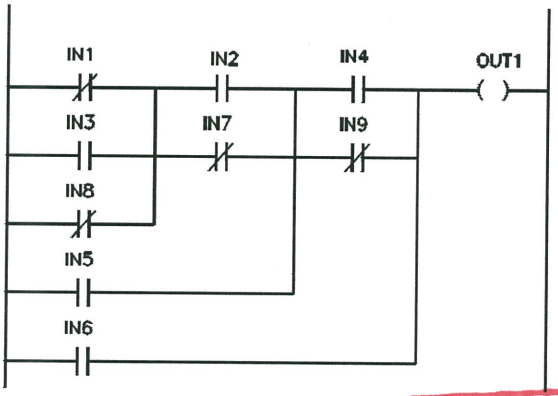

Figure Q2(a)

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Ladder diagram

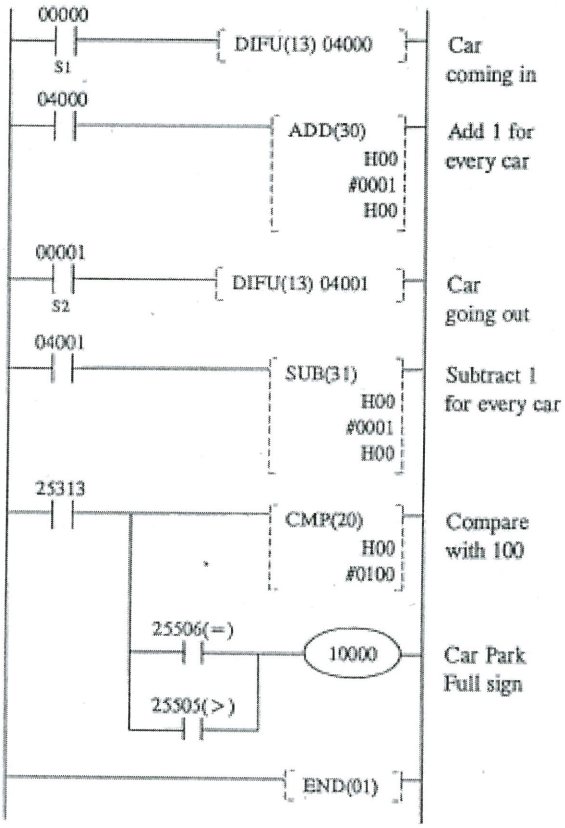

Figure Q2(b)

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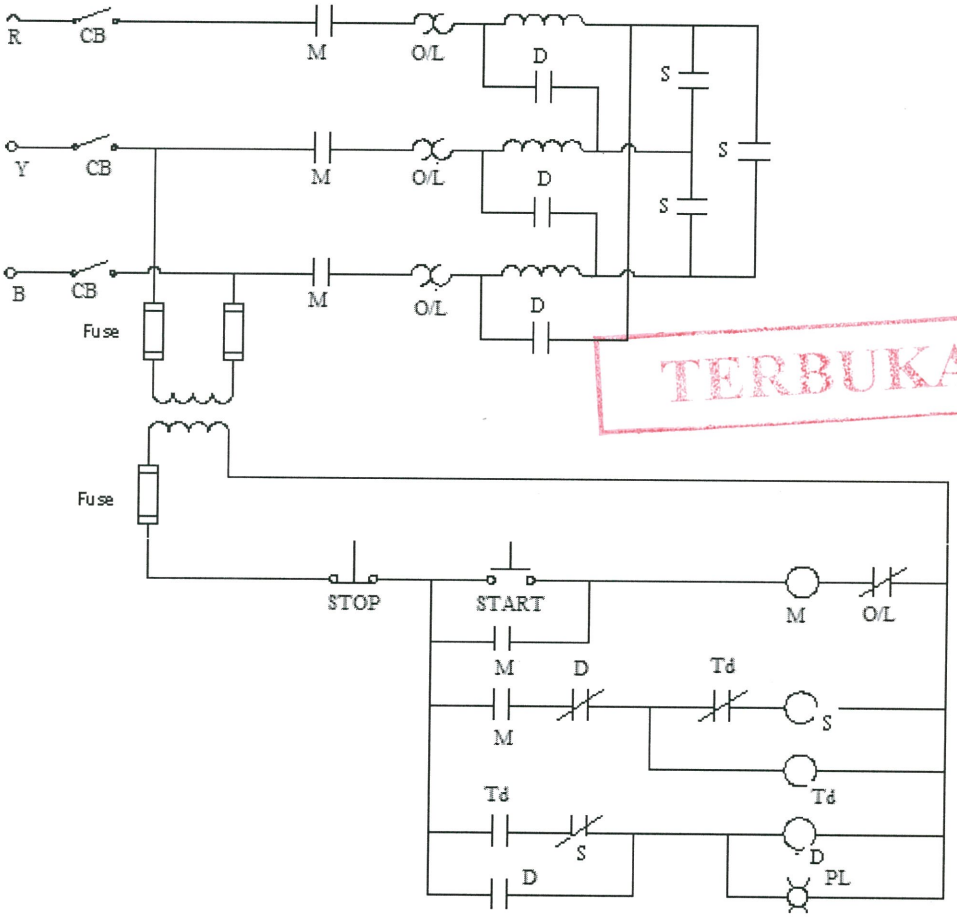

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Figure Q3

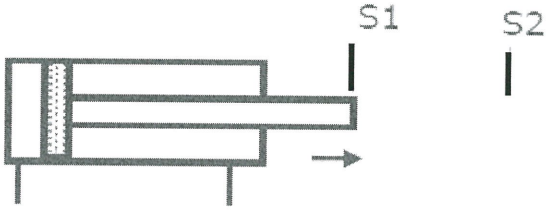

Figure Q4