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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2019/2020**

COURSE NAME : INDUSTRIAL ELECTRONIC  
COURSE CODE : BND 22303  
PROGRAMME CODE : BND  
EXAMINATION DATE : DECEMBER 2019 / JANUARY 2020  
DURATION : 3 HOURS  
INSTRUCTION : ANSWERS **FOUR (4) QUESTIONS ONLY**

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THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

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- Q1** (a) State a full name of:
- (i) TRIAC (1 marks)
  - (ii) Op - Amp (1 marks)
- (b) By referring the op amp circuits given in **Figure 1**,
- (i) derive the gain of the circuit. (4 marks)
  - (ii) calculate the value of feedback resistor, if  $V_o = 6\text{ V}$ ,  $R_f = 10\text{ k}\Omega$ . (4 marks)
- (c) **Figure 2** shows a circuit that include four types of op-amp which are arrange in cascade configuration.
- (i) Name the type of **Op-Amp A, B, C and D** referring to the circuit. (4 marks)
  - (ii) Calculate the value of  $V_o$ . (11 marks)
- Q2** (a) Draw the layer representation of a Silicon Controlled Rectifier (SCR). (2 marks)
- (b) Illustrate the **TWO (2)** transistor electrical equivalent circuits of SCR. (3 marks)
- (c) Briefly explain and illustrate the characteristic curves of SCR. (10 marks)
- (d) Referring to **Figure 3**, determine and redraw the circuit for gate triggering signal of SCR by the following applications:
- (i) DC signals (5 marks)
  - (ii) AC signals (5 marks)

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- Q3** (a) Differentiate the function OR and OR LD in a ladder logic diagram construction. (4 marks)
- (b) Construct the ladder logic diagrams for the following Boolean logic equations:
- (i)  $A = (01 \cdot 02' + 03) \cdot 04 + (05 \cdot 06')$  (3 marks)
- (ii)  $B = (07' \cdot 08) + (08 + 09' \cdot (10 \cdot 11')) \cdot 12$  (3 marks)
- (iii)  $C = 13' + (14 + 15' \cdot (16 + 17')) \cdot 18 + 19 \cdot 20'$  (3 marks)
- (c) Construct the instruction list (mnemonic code) for the ladder diagram shown in **Figure 4**. (12 marks)
- Q4** (a) With the aid of diagram, illustrate the basic components of Programmable Logic Controller (PLC). (5 marks)
- (b) In the **Figure 5**, a tank will be filled with two chemicals, mixed, and then drained. When the Start button is pressed, the program will start Pump 1. Pump 1 runs for 10 seconds, filling the tank with the first chemical, then shuts off. The program then starts Pump 2 to fills the tank with second chemical until float switch is triggered then shut off automatically. At the same time, the program starts the mixer motor to mixes these two chemicals for 60 seconds. The program then opens the drain valve and starts Pump 3. Pump 3 shuts off after 15 seconds and the process stops. A manual Stop switch is also available in the system.
- (i) Identify the input and output. (5 marks)
- (ii) Describe the process flow by motion diagram. (5 marks)
- (iii) Construct the PLC ladder diagram for the system. (10 marks)

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- Q5** (a) Briefly explain the operation of double acting cylinder with 3/2 way directional valve. (6 marks)
- (b) A pneumatic system is operated at a pressure of 1000 kPa. Calculate the diameter of cylinder required to move a load at 500 N of force. (5 marks)
- (c) A hydraulic cylinder is to be used to move a work parts in a manufacturing operation through a distance of 30 mm in 6 seconds. A force of 15 kN is required to move the work parts. Determine the required working pressure and hydraulic liquid flow rate if a cylinder with a piston diameter as follows:
- (i) 50 mm. (7 marks)
- (ii) 120 mm. (7 marks)

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- END OF QUESTIONS -

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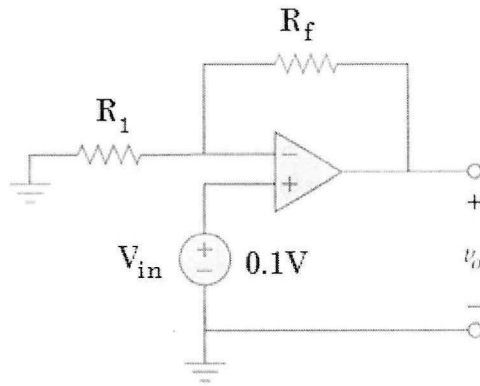


Figure 1

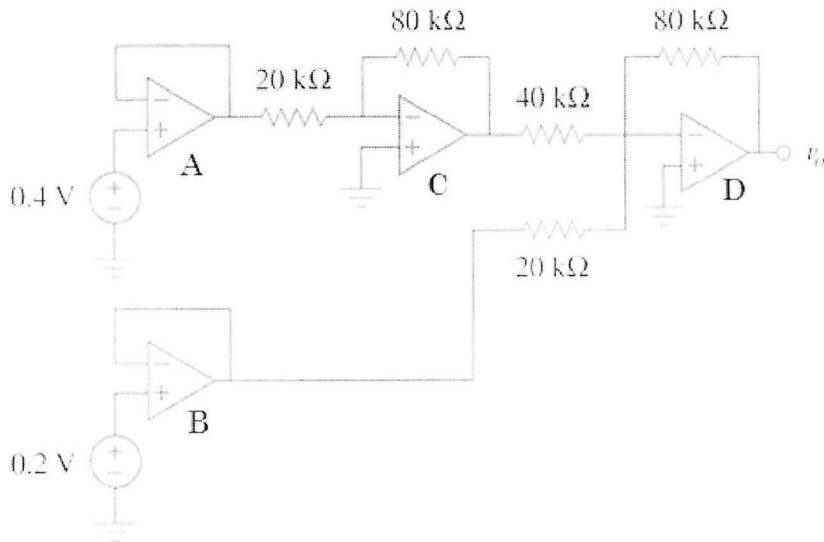


Figure 2

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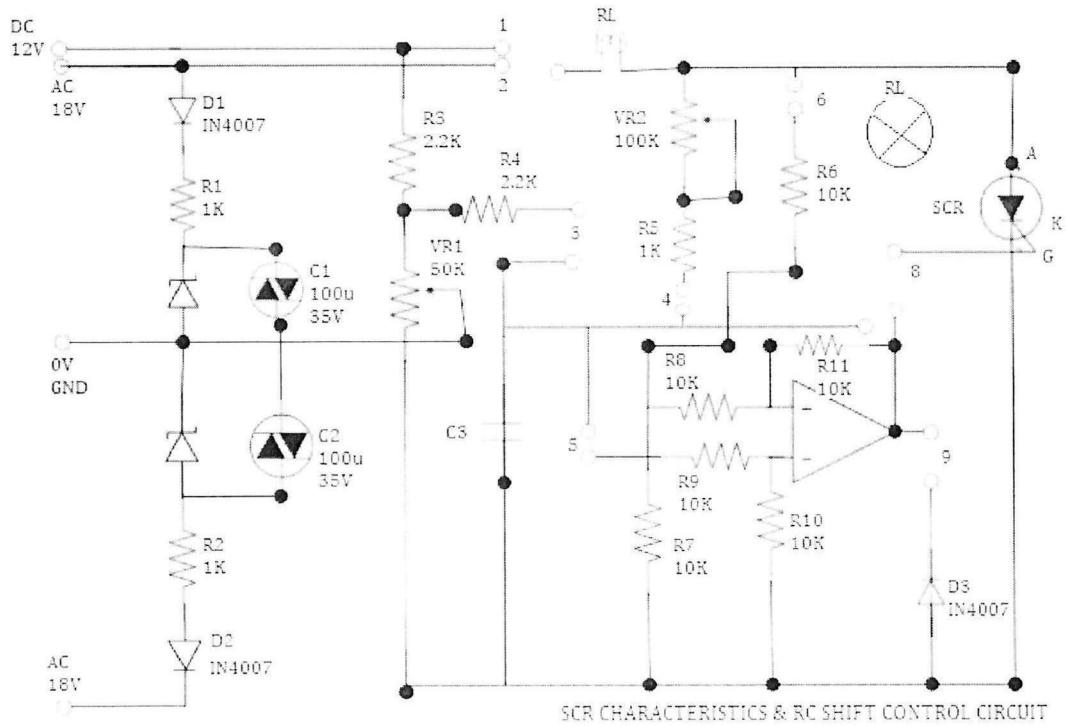
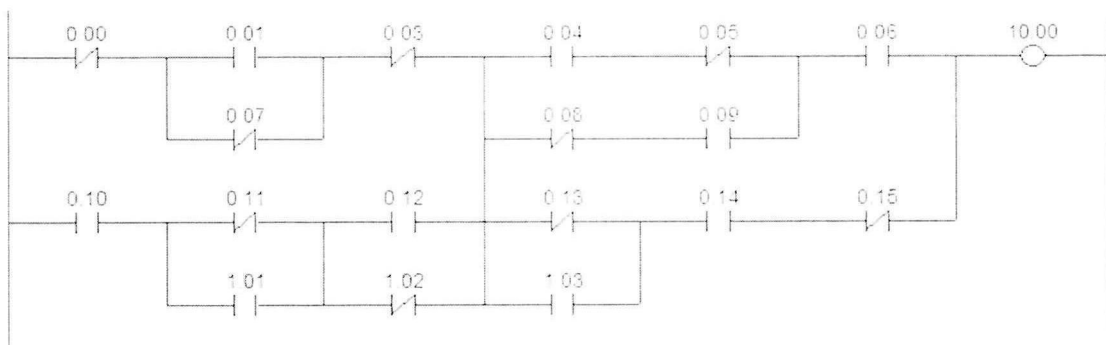


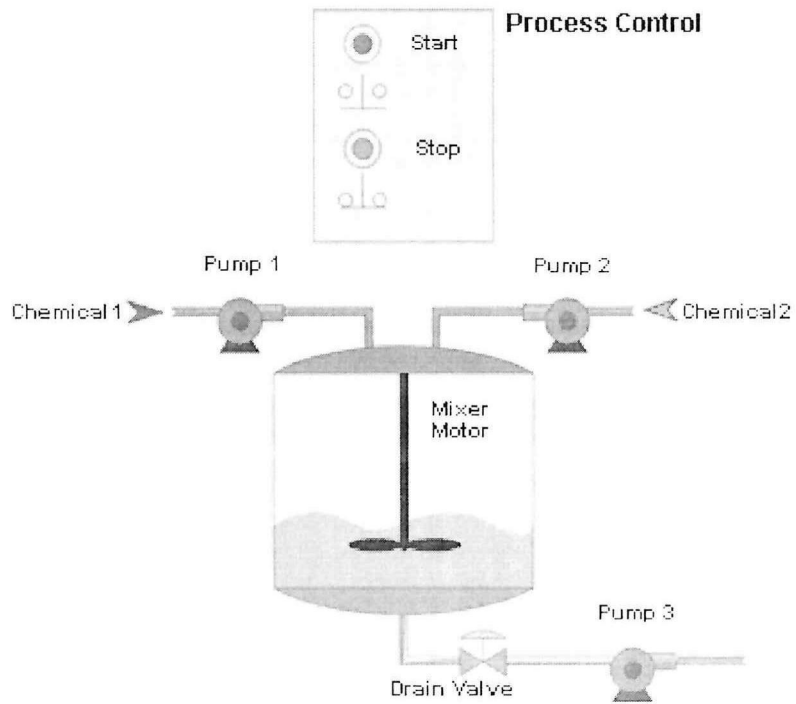
Figure 3



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**Figure 5**