Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	ELECTRONIC CONTROL TECHNOLOGY
COURSE CODE	:	BNR 23003
PROGRAMME	:	BNE
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

Q1 (a) An electronic control systems is a process that transforms one signal into another. Draw and label in detail for an audio control system, explain the audio system based on your drawing.

(5 marks)

(b) A control system can generally classified by how they control variables, either manually in an open-loop system or automatically in a closed-loop system. **Figure Q1 (b)** shows the open loop reservoir system. From this figure:

(i) explain how the open loop reservoir system works.

(3 marks)

(ii) forecast **TWO (2)** possible example of disturbance that might happen to this system.

(2 marks)

(c) Based on your answer in **Q1 (b)(ii)**, develop a self-correcting close loop reservoir system to solve the disturbance problems. Justify your answer with the aid of drawing and explain how this close loop reservoir system works.

(7 marks)

(d) There are several elements required in closed loop system for continuous monitoring and self-correcting action of the operation for long periods of time without interruption.

(i) Determine the function of measurement device in a system? Identify the measurement device used in the close loop reservoir system in **Q1 (c)**.

(3 marks)

(ii) Determine the function of actuator in a system. Identify the actuator used in the close loop reservoir system **Q1 (c)**.

(3 marks)

(e) A parallel connected electronic system are shown in **Figure Q1 (e)**. Draw an equivalent single output system corresponding to this parallel system.

(2 marks)

Q2 (a) Operational Amplifiers are one of the basic blocks of analogue electronic circuits.

(i) List down **TWO (2)** types of the Op-amp that you familiar with.

(2 marks)

(ii) Illustrate and label the **TWO (2)** types of Op-amp that named in question **Q2 (a) (i)**.

(4 marks)

(b) **Figure Q2 (b)** shows a summing amplifier. If $R_1 = 20\ k\Omega$, $R_2 = 10\ k\Omega$, $R_3 = 6\ k\Omega$ and $R_F = 8\ k\Omega$, analyze:

(i) current flow through R_1, R_2, R_3 and R_F,

(4 marks)

(ii) the output voltage, V_o

(2 marks)

(iii) if there is a resistor, $R_L = 4\ k\Omega$ attached to the amplifier as shown in **Figure Q2(b)(iii),** determine the output current, i_o for the amplifier.

(2 marks)

(c) A cascaded op-amp is shown in **Figure Q2 (c)**,

(i) determine the types of each op-amp at each stage.

(2 marks)

(ii) obtain the output voltage, V_o for the op-amp shown in **Figure Q2 (c)**.

(6 marks)

(d) **Figure Q2 (d)** shows the operation waveform of a type of op-amp. The amplifier shown in the figure continuously increases its gain over a period of time. Justify and draw the op-amp that explain to this operation waveform.

(3 marks)

Q3 (a) **Figure Q3 (a)** shows a logic circuit consist of OR, AND and NOT gate .

(i) Analyze the logic circuits using truth table (please show your truth table).

(2 marks)

(ii) Construct the ladder diagram.

(3 marks)

(b) **Figure Q3 (b)** shows the ladder ladder diagram of a lamp controlled by a start and a stop button. Replace the start push button with a sensor and construct the corresponding electric circuit diagram.

(4 marks)

(c) **Figure Q3 (c)** shows the reversible motor control circuit. When contactor M1 is energized, the 3 phases (A, B, and C) are connected directly to terminals 1, 2, and 3 of the motor, respectively. However, when contactor M2 is energized, phases A and B are reversed, where A going to motor terminal 2 and B going to motor terminal 1. This reversal of phase wires results in the motor spinning the opposite direction.

(i) Design the ladder diagram for the whole circuit as shown in **Figure Q3 (c),** bear in mind that we don't want the forward and reverse contactors energized simultaneously.

(5 marks)

(ii) Using the ladder diagram developed in question **Q3 (c) (i),** explain how to avoid the two incompatible events occur at the same time.

(4 marks)

(d) Construct the ladder diagram that correspond to digital logic given by Boolean function below.

(i) $F = A \cdot B' \cdot C$

(ii) $F = T \cdot (B_1 \cdot B_2' + B_1' \cdot B_2)$

(5marks)

(e) Construct the ladder diagram that correspond to logic circuit as shown in **Figure Q3 (e).**

(2 marks)

Q4 (a) 555 timer is an 8-pin IC that is capable of producing accurate time delays and/or oscillators. Identify **THREE (3)** operating modes of 555 Timer IC.

(3 marks)

(b) For the 555 timer oscillator shown in **Figure Q4 (b),** calculate the circuit's period (*T*), frequency *(F)*, and duty cycle (*DC*).

(5 marks)

(c) Identify **TWO (2)** functions in PLC and explain the role of each function.

(4 marks)

(d) **Figure Q4 (d)** shows the motor start-stop control circuit using PLC interface with programmed ladder diagram. Draw an appropriate input and output connections with it's correspond proper ladder diagram to perform start and stop motor control.

(4 marks)

(e) When a Push Button (PB 1) is pressed, a timer will start to count for 5 seconds. After 5 seconds, a lamp and a buzzer will turn on. A Push Button (PB 2) is needed to turn off the lamp and buzzer. Based on the given problem,

(i) assign the input and output for the system.

(2 marks)

(ii) develop the ladder diagram.

(5 marks)

(iii) construct the electric circuit diagram.

(2 marks)

- END OF QUESTIONS –

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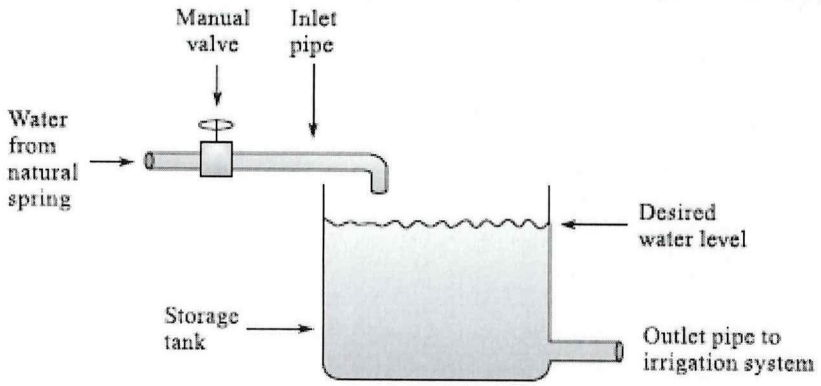

Figure Q1(b)

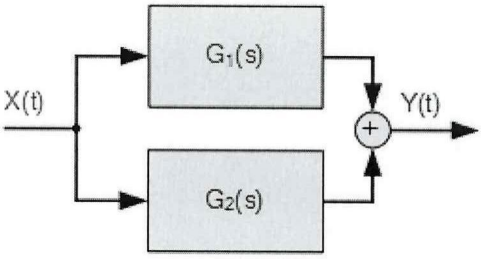

Figure Q1(e)

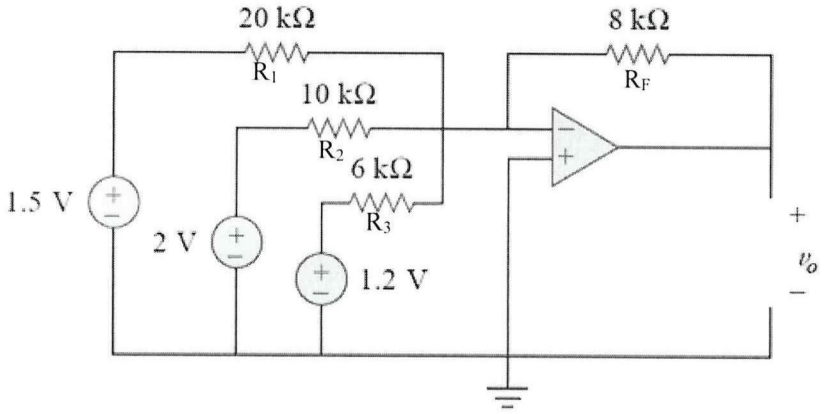

Figure Q2(b)

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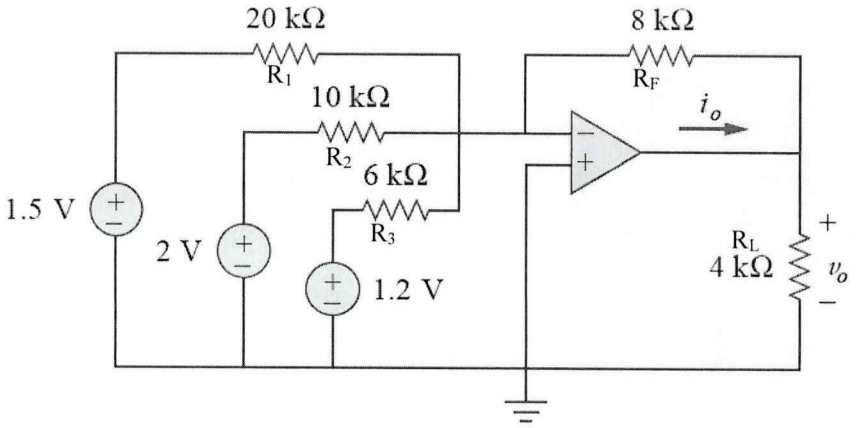

Figure Q2(b)(iii)

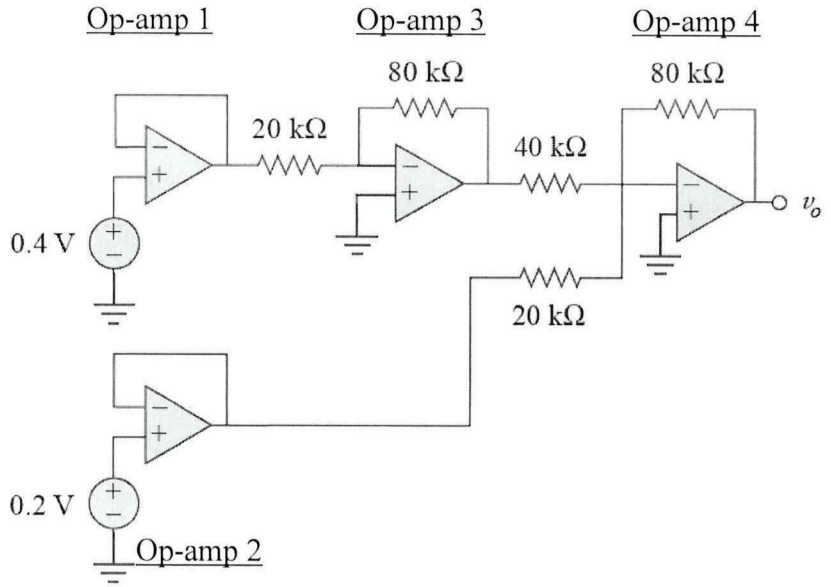

Figure Q2(c)

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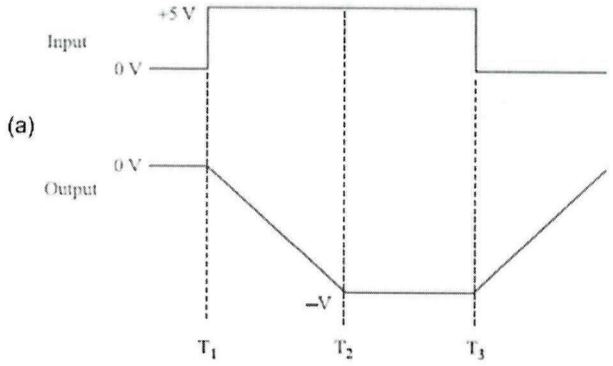

Figure Q2 (d)

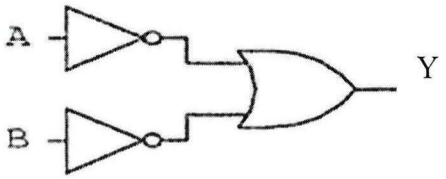

Figure Q3 (a)

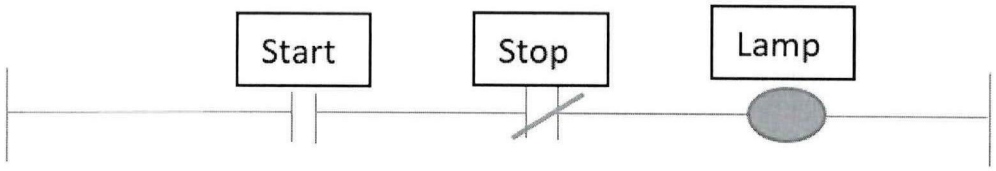

Figure Q3 (b)

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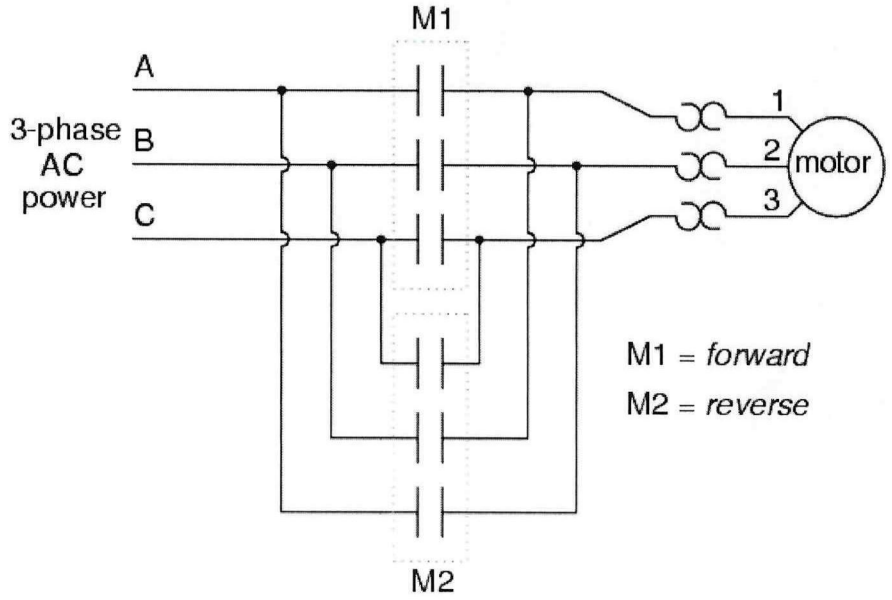

Figure Q3 (c)

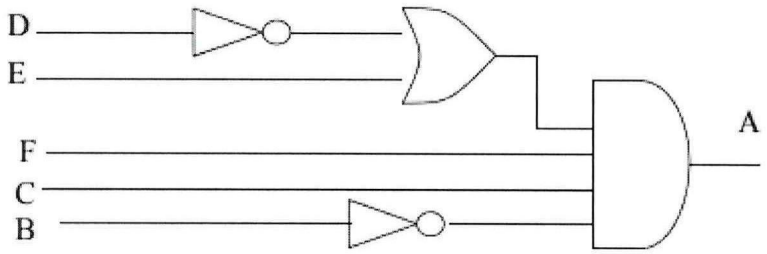

Figure Q3 (e)

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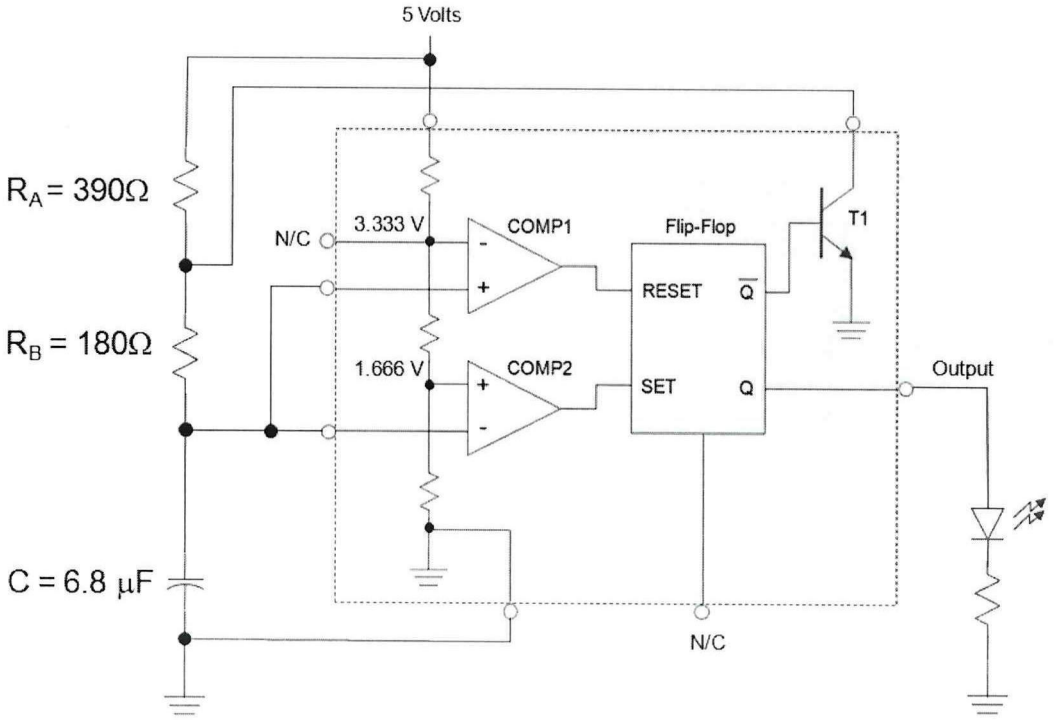

Figure Q4 (b)

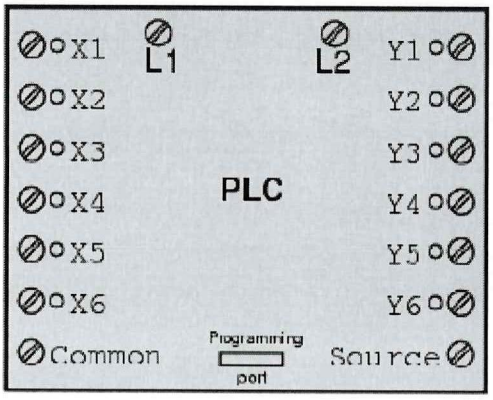

Figure Q4 (d)