Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	INDUSTRIAL ELECTRONICS
COURSE CODE	:	DAE 32003
PROGRAMME	:	2 DAE
EXAMINATION DATE	:	JUNE /JULY 2016
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 (a) Relay is an electrical switch that opens and closes under electromagnetism condition.

(i) Name all major parts of relay.

(3 marks)

(ii) Sketch **four (4)** different types of relay protection circuit.

(4 marks)

(b) **Figure Q1(b)** illustrates an electromechanical device;

(i) Name the device.

(1 marks)

(ii) Explain how it operates with the aid of a sketch.

(4 marks)

(iii) Describe in detail **one (1)** actual application of the device.

(4 marks)

(c) Based on **Figure Q1(c)**,

(i) Produce a truth table for this circuit's function.

(4 marks)

(ii) Determine the logic function it represents.

(1 marks)

(iii) Modify the circuit in **Figure Q1(c)** so that it will represent an OR logic function.

(4 marks)

Q2 (a) A Programmable Logic Controller (PLC) is a microprocessor based system which uses a programmable memory for implementing specific functions such as logic, sequencing, timing, counting and arithmetic to control various types of machines or processes through analog or digital input/output modules. Name **four (4)** major components of a PLC system.

(4 marks)

(b) Referring to **Figure Q2(b)**,

(i) Classify the timing function used.

(1 marks)

(ii) Describe the operation of the system.

(6 marks)

(iii) Write down the mnemonic code for the ladder diagram.

(4 marks)

(c) A robotic system as shown in **Figure Q2(c)** work as follows:

A sensor is placed outside yellow line that enclosed the robot to provide safety cautions to the user. If the sensor detects someone crossing the yellow line, the robot will automatically stop its operation and the siren will ON until a reset button is pressed. Then the push button needs to be pressed for robot to run again.

Draw the ladder diagram of the robotic system. Use KEEP instruction to solve these problems instead of normal latching.

(10 marks)

Q3 (a) **Figure Q3(a)** shows a type of solenoid valve.

(i) State the valve type.
(ii) Sketch **two (2)** other types of solenoid valve.

(7 marks)

(b) **Figure Q3(b)** shows the operation of a pneumatic system with a solenoid valve and a double acting cylinder. Describe the operation of the pneumatic system when the solenoid is energized and de-energized.

(8 marks)

(c) A single acting cylinder will extend when push button is pressed. A lamp will ON when the cylinder has fully extended (use limit switch to detect the extension position). After 4 seconds, the piston will retract to its initial position and the lamp will switch OFF.

Construct the electrical diagram and ladder diagram of the pneumatic system.

(10 marks)

Q4 (a) With the aid of diagram, explain the following circuit;

(i) op-amp
(ii) comparator

(6 marks)

(b) For the circuit in **Figure Q4 (b)**, draw and label the output waveform, V_{out} (V_{in} is a sinusoidal waveform). State the name of this circuit.

(6 marks)

(c) The circuit in **Figure Q4 (c)** is used in sensor conditioning circuits. It is a filter circuit as well as an integrator.

(i) Calculate the cutoff frequency and gain in dB of this filter.

(5 marks)

(ii) If the filter needs the gain of 13.98 dB, determine the value of R_f without changing the value of R_1 and C. Calculate the new value of cutoff frequency.

(5 marks)

(iii) Describe when will this circuit acts as an integrator.

(3 marks)

Q5 (a) Define stepper motor.

(4 marks)

(b) Stepper motor has two modes of operation; full step and half step. Explain clearly the following modes of four phase stepper motor and use appropriate diagrams to support your answer.

(i) One-ON full step
(ii) Two-ON full step
(iii) One-ON, two-ON half step

(15 marks)

(c) Calculate the resolution of 4-phase hybrid stepper motor with a 3.6 ° step angle if the stepper motor operated in :

(i) full step
(ii) half step

(6 marks)

Q6 (a) Define PWM (Pulse Width Modulator). How it is use to control direct current motor speed?

(5marks)

(b) Describe full operation of the chopper in controlling series motor as shown in **Figure Q6 (b)**.

(10 marks)

(c) A 110 hp dc series motor rated 200 A is operating in a chopper circuit from a 500 V dc source. The armature and field inductance is 0.06H, at the minimum ratio t1/ (t1 + t2) of 0.20. Find the pulse frequency to limit the amplitude of armature current excursion to 10A.

(10 marks)

- END OFQUESTION -

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SEMESTER/SESSION: SEM II/2015/2016 PROGRAMME: 2 DAE
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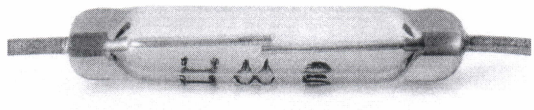

FIGURE Q1(b)

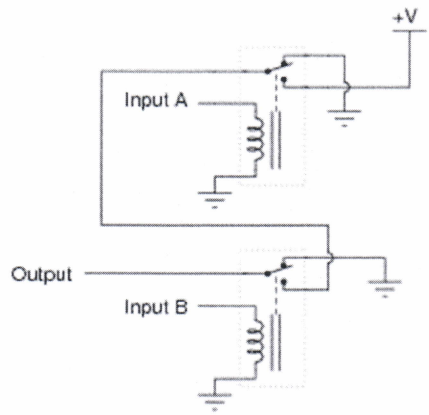

FIGURE Q1(c)

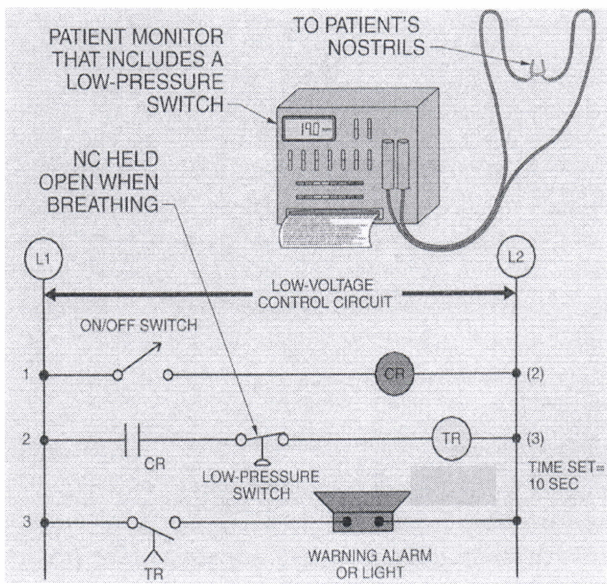

FIGURE Q2(b)

FINAL EXAMINATION

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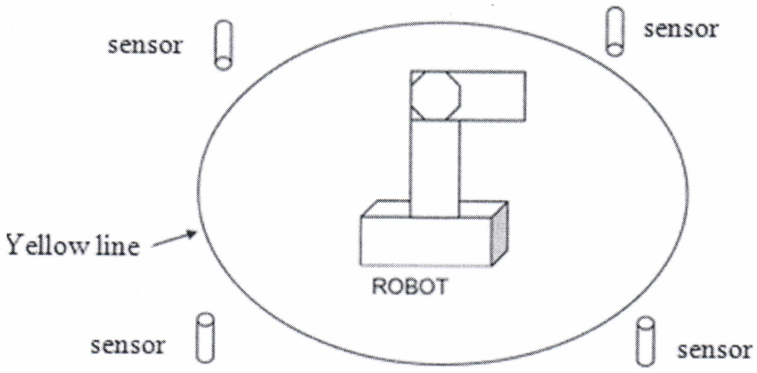

FIGURE Q2(c)

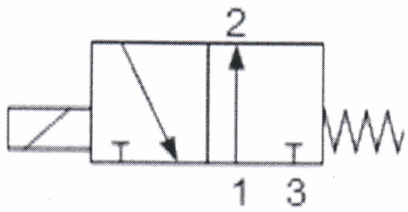

FIGURE Q3(a)

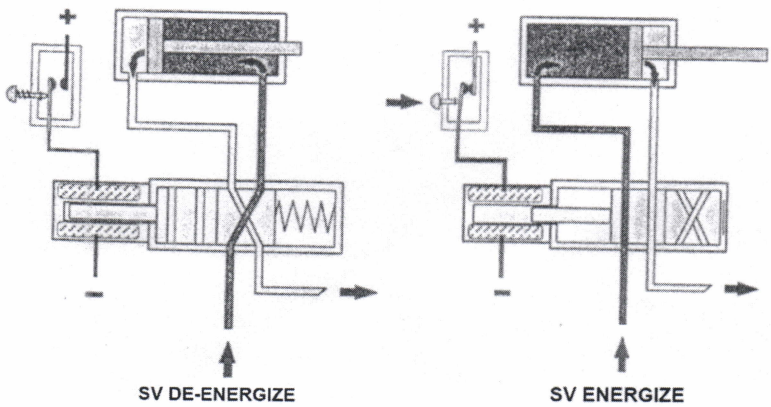

FIGURE Q3(b)

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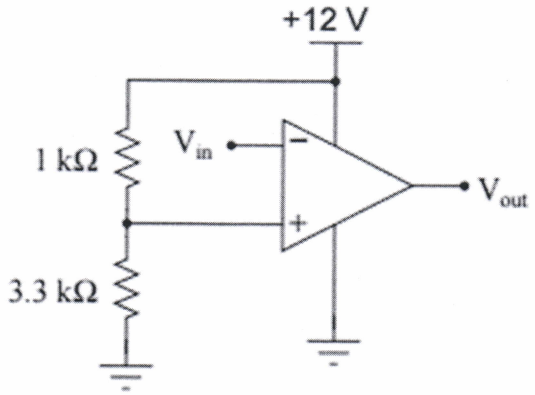

FIGURE Q4 (b)

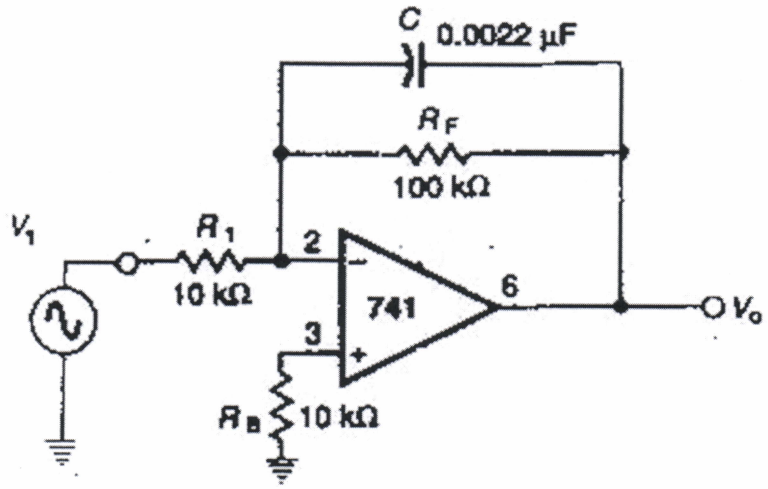

FIGURE Q4 (c)

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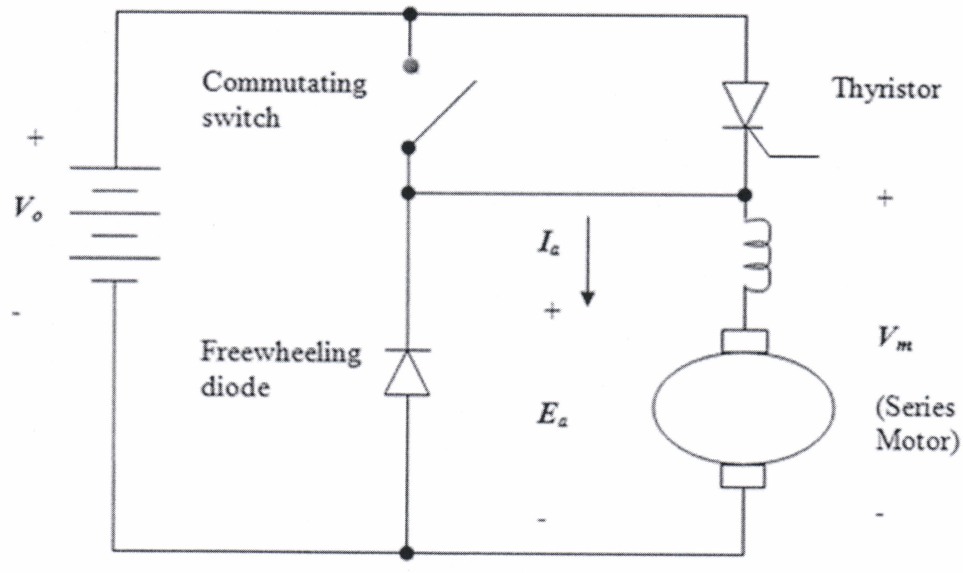

FIGURE Q6(b)