Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	MECHATRONIC SYSTEM
COURSE CODE	:	MEM10103
PROGRAMME CODE	:	MEE
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS **OPEN BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **THREE (3)** PAGES

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Q1 (a) i. What are the key elements of Mechatronics system?

(2.5 marks)

ii. List **TWO (2)** mechatronics applications?

(2.5 marks)

(b) Mention the functions of a Mechatronics system.

(3 marks)

(c) Linear variable differential transformer (LVDT) is a primary transducer used for measurement of linear displacement with an input range of about ± 2 to ± 400 mm in general. List the applications of potentiometer sensor in/around your home and office/university

(7 marks)

(d) Bio-MEMS is an abbreviation for biomedical (or biological) microelectromechanical systems. Bio-MEMS has considerable overlap, and is sometimes considered synonymous, with lab-on-a-chip (LOC) and micro total analysis systems (μTAS). Propose an application of this technology with a brief description.

(10 marks)

Q2 (a) Design a hydraulic power system that consists of an electrical motor, a pump, a non-return valve, a pressure-relief valve and an accumulator to pump oil from a sump with a concise description about its operation.

(10 marks)

(b) Hydraulic brake is a type of braking system which is widely used in the automobiles with the application of the hydraulic fluid. The working principle of hydraulic braking system is purely based upon Pascal's law, which states that the intensity of pressure exerted inside a closed system by the liquid is always equal in all the directions. Investigate the function of each components that involved in the hydraulic brake system for automobiles.

(15 marks)

Q3 (a) A push button with a pull-up resistor is connected to D10. A blue LED was connected to D11 with sourcing mode. A red LED was connected to D11 with sinking mode. Arduino Uno microcontroller is used to ensure that the blue LED will light up but the red LED will not light up when the push button is not pressed, and vice versa.

(i) Sketch a complete schematic diagram for this system.

(5 marks)

(ii) Generate a complete C programming.

(10 marks)

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(b) For a real-time system with three tasks of TA(5,10), TB(1,5), and TC(3,10) in which the priority level is TB > TC > TA.

(i) Sketch the activation diagram of this system

(4 marks)

(ii) Analyse the status of these tasks at time 5.5ms and 7.5ms.

(6 marks)

Q4 (a) As an engineer, you are required to design a system to automatically turn on a single phase 12V shunt DC motor for three seconds when a compact photoelectric sensor CX-422 (NPN output type) detects an object in which the object and background are close together using an ESP32 microcontroller.

(i) Design a circuit to interface all components with concise labels and explanation.

(7 marks)

(ii) Justify the pinout selection of the microcontroller in **Q4(a)(i)**.

(2 marks)

(iii) Generate a C programming to produce the desired functionality.

(6 marks)

(b) A 12 V shunt DC motor has an armature resistance of 0.5 Ω and a field resistance of 100 Ω. The line current at full load is 2 A. At no load, the DC machine takes a line current of 0.5 A while running at 2500 rpm.

(i) Analyse the field current and the induced voltage when there is no load.

(5 marks)

(ii) Analyse the full load speed and the speed regulation of the DC motor.

(5 marks)

– END OF QUESTIONS –

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