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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2022/2023**

COURSE NAME : MEDICAL INSTRUMENTATION  
COURSE CODE : BEJ 45303 / BEU 40503  
PROGRAMME CODE : BEJ  
EXAMINATION DATE : JULY / AUGUST 2023  
DURATION : 3 HOURS  
INSTRUCTION : **1.ANSWER ALL QUESTIONS. THIS QUESTION PAPER MUST BE RETURNED**  
**2.THIS FINAL EXAMINATION IS CONDUCTED VIA CLOSED BOOK**  
**3.STUDENTS ARE PROHIBITED TO CONSULT THEIR OWN MATERIAL OR ANY TYPE OF EXTERNAL RESOURCES DURING THE EXAMINATION**

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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**Q1** (a) Medical Instrument is designed to measure various biomedical and physiological parameters. Point out the general constraints in designing a medical instrumentation system.

(4 marks)

(b) While designing a measurement system for medical applications there are some additional constraints that need to be considered. Point out the additional constraints.

(9 marks)

(c) Describe the **SIX (6)** types of medical instruments.

(12 marks)

**Q2** (a) Draw the **TWO (2)** mode of sensors orientation in the Pulse Oximetry System.

(10 marks)

(b) Design the complete sketch of Pulse monitoring system. Your design should consist of (Block diagram, Circuit or Component, Signal Type and Input/Output Signal).

(15 marks)

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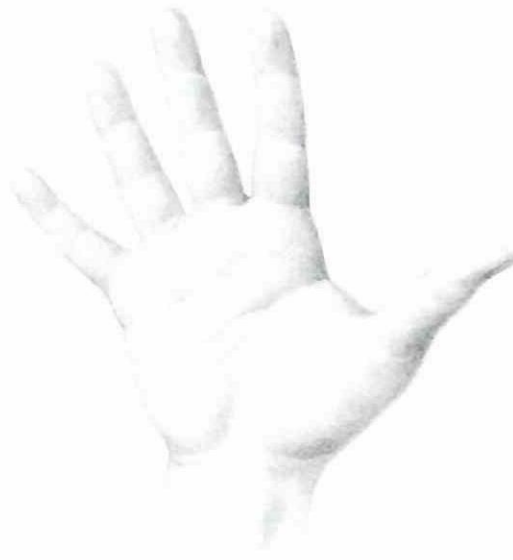
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**Q3** As a medical electronic engineer, produce a specific design idea for a monitoring device in which the design may assist the following problems (rationalise the signaling condition in your suggestion):

- (a) People with Carpal Tunnel Syndrome may have numbness, tingling, weakness, or muscle damage in the hand and fingers. The Carpal Tunnel Syndrome is a condition in which there is excessive pressure on the median nerve. This is the nerve in the wrist that allows feeling and movement to parts of the hand.

(6 marks)



Reason for system design and sensor position.

(6.5 marks)

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- (b) Arm rehabilitation process requires the patients to do repetitive physical exercises such as arm inward folding movement. Without knowing their improvement rate may result in loss of interest or de-motivate the patients thus, they may struggle to complete rehabilitation process.

(6 marks)



Reason for system design and sensor position.

(6.5 marks)

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- Q4** Cell Culture activities could be performed by using human and animal cell. The cells are originally derived from the human or animal and further processed in the lab into cell line.
- (a) Explain in detail the difference between In-vivo and In-Vitro. (4 marks)
  - (b) Demonstrate the complete cycle of Cell Culture procedure in the biological lab from initial (Confluence to Splitting and Re-Plating the cells). Explain the process involved. (9 marks)
  - (c) An established method for pores creation on the cell membrane known as Electroporation. Describe this technique and the process that happens to the cell. (4 marks)
  - (d) There are two types of voltage level or voltage range available in the Pulse Electric Field System. State the two types of voltage. (4 marks)
  - (e) In the Pulse Electric Field System there are TWO parameters that can be varied during the experiments. State the TWO parameters. (4 marks)

- END OF QUESTIONS -

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