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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME : MEDICAL INSTRUMENTATION
COURSE CODE : BEU 40503
PROGRAMME CODE : BEJ
EXAMINATION DATE : DECEMBER 2019/ JANUARY 2020
DURATION : 2 HOURS 30 MINUTES
INSTRUCTION : ANSWERS ALL QUESTIONS

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

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Q1 (a) Classify the following statement:

If any conductor is raised to a potential above that of earth, some current is bound to flow from that conductor to earth. This is true even of conductors that are well insulated from earth, since there is no such thing as perfect insulation or infinite impedance. The amount of current that flows depends on:

- (i) The voltage..... (2 marks)
- (ii) The capacitive (2 marks)
- (iii) The resistance..... (2 marks)

(b) The current that flow from or between conductors that are insulated from earth and from each other are called leakage currents, and are normally small. However, since the amount of current required to produce adverse physiological effects is also small such currents must be limited by the design of equipment to safe values. Illustrate and describe the **FOUR (4)** types of leakage current. (19 marks)

Q2 (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) Demonstrate the **SIX (6)** types of Medical Instruments with examples. (12 marks)

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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.

(12 marks)

(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.

(13 marks)

Q4 Many people think that the blood pressure in the aorta is equivalent to that in the brachial artery. However, there are differences between the central aortic blood pressure and the invasively obtained peripheral blood pressure.

(a) Explain the difference between Diastolic and Systolic pressure.

(5 marks)

(b) The non-invasive, quantitative measurement of blood pressure was introduced by Riva-Rocci in 1896, and refined by the auscultatory method of Korotkoff in 1905. Demonstrate the principle of auscultatory blood pressure measurement system along with the pressure graph.

(8 marks)

(c) The human heart has the polarization and depolarization activity according to its mechanical excitation properties. Draw the electrophysiological of heart (electrical event) and point out the PQRST waveforms for each of the specialized heart compartment or muscles as in measurement which produces the Electrocardiography (ECG) signals.

(12 marks)

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-END OF QUESTIONS -