Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	BIOMEDICAL ENGINEERING & APPLICATIONS
COURSE CODE	:	BEJ 45703
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER ALL QUESTIONS. 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.** 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Ergonomics or human factor is another important aspect in rehabilitation engineering and assistive technology.

(i) List down **SEVEN (7)** principles that govern the rehabilitation engineering.

(7 marks)

(ii) If you are assigned to design a rehabilitation device for an elderly person, which ergonomic principles that you think are very important to be considered and justify your reasons. **Remark:** You must include **TWO (2)** ergonomic principles that are most relevant with the subject of interest (elderly person).

(6 marks)

(b) Based on principle of proper positioning, suggest seating considerations for the following conditions:

(i) Cerebral palsy (increased tone and decreased tone)

(4 marks)

(ii) Spinal cord injury

(2 marks)

(iii) Osteogenesis imperfecta

(1 mark)

Q2 (a) Describe **FIVE (5)** major misconception that you can relate to assistive technology.

(10 marks)

(b) In your opinion, suggest **FIVE (5)** possible future rehabilitation engineering research that can help to improve the quality of individual life?

(10 marks)

Q3 A 1-D signal is an ordered sequence of numbers that describes the trends and variations of a quantity whereas a multidimensional signal is a multidimensional sequence of numbers ordered in all dimensions.

(a) Differentiate between 1-D analog, discrete, and digital signals by using relevant example. Sketch a diagram for each of these signals to support your explanation.

(6 marks)

(b) Based on **Figure Q3(b),** discuss in detail, how the ECG signal is being processed starting from the sensor.

(10 marks)

(c) Develop a MATLAB code to build an image from a matrix.

(4 marks)

Q4 (a) A model is a representation of a real phenomenon. Two ways to model a system is either by using a conservation law or a compartment model.

(i) Derive and explain a formula that is used to quantify a system with a conservation law.

(6 marks)

(ii) Based on **Q4(a)(i),** sketch a graphical representation using conservation equation.

(1 mark)

(b) **Figure Q4(b)** shows a simple compartment model of fluid flowing from the gut to the blood to the kidney. Using the concept of volume balance, analyse and describe how the fluid flows, the units for k_1, k_2, k_3 and k_4, and derive all possible differential equations associated with this system.

(13 marks)

Q5 (a) In your own words, define what is biotechnology, and how it helps to heal the world.

(5 marks)

(b) Describe the culture cells process using a relevant process diagram.

(10 marks)

(c) Briefly explain **THREE (3)** essential macromolecules of living organism and conclude the relationship of these three elements.

(5 marks)

– END OF QUESTIONS –

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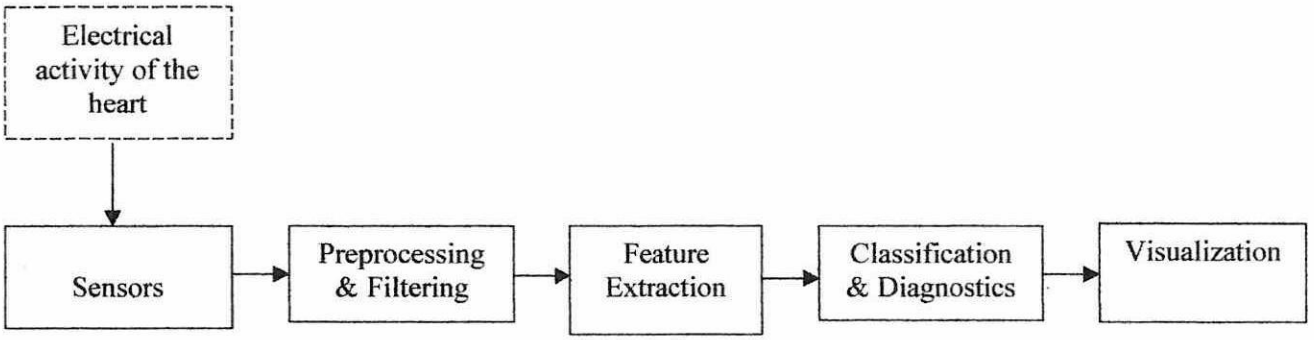

Figure Q3(b)

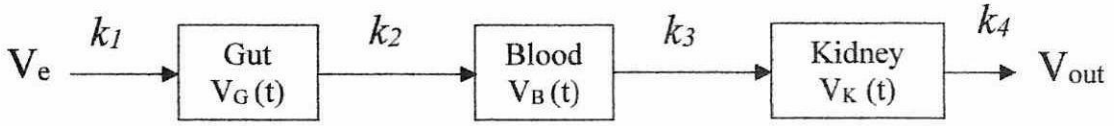

Figure Q4(b)