UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	PRINCIPLE OF PHYSIOLOGICAL DEVICES
COURSE CODE	:	BEU 30203
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	DECEMBER 2018/ JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER ALL QUESTIONS IN THE QUESTION BOOKLET.

THIS QUESTION PAPER CONSISTS OF **FOURTEEN (14)** PAGES

Q1 (a) Distinguish between a sensor and a biosensor.

(3 marks)

SOLUTION

(b) A glucose sensor is a device that monitors the level of blood glucose in human. Generally, there are two types of the glucose sensor which is based on the optical biosensor or the electrochemical biosensor. Explain the principle of the optical-type glucose sensor.

(5 marks)

SOLUTION

(c) There are three types of electrochemical biosensors which are potentiometric, amperometric, and conductometric electrochemical biosensors. Give **ONE (1)** example of application for each of them.

(3 marks)

SOLUTION

(d) According to a piezoelectric effect, piezoelectric sensors are used as physical sensors in order to sense mass, or used with bioreceptors as biosensors in order to quantify biomolecules.

(i) Describe the piezoelectric effect.

(2 marks)

SOLUTION

(ii) Explain on how the piezoelectric sensor can be used as a biosensor.

(8 marks)

SOLUTION

(e) A lab-on-a-chip (LOC) is a device that integrates several laboratory functions onto a small platform, typically only millimeters or centimeters in size. It is also referred to as a micro fluidic device or micro fluidic chip. Justify on why the LOC is also referred as a micro fluidic device or micro fluidic chip.

(4 marks)

SOLUTION

Q2 (a) Transducer is a device that converts energy into a corresponding signal with a different energy form. Classify the transducer into **THREE (3)** categories. Elaborate each classification of the transducer by giving an appropriate example for each category.

(9 marks)

SOLUTION

(b) "Several considerations must be done when choosing a transducer to study a specific phenomenon." Justify the statement for the following aspects mentioned in **Q2 (b) (i) – (iii).**

(i) Operating range
(ii) The order of accuracy
(iii) Environment compatibility

(6 marks)

SOLUTION

(c) Discuss **THREE (3)** advantages of using thermistors for measuring temperature over thermocouples and resistance thermometers.

(6 marks)

SOLUTION

(d) Strain gauge pressure transducer is based upon the changes in resistance of a wire produced due to small mechanical displacements. Formulate the Gauge Factor, G to describe the overall behavior of a wire under stress in the transducer. Define all parameters used in the formula.

(4 marks)

SOLUTION

Q3 (a) A basic electronic recording signal from human body is shown in **Figure Q3 (a)**. Elaborate the **THREE (3)** important components shown in the **Figure Q3 (a)**.

(6 marks)

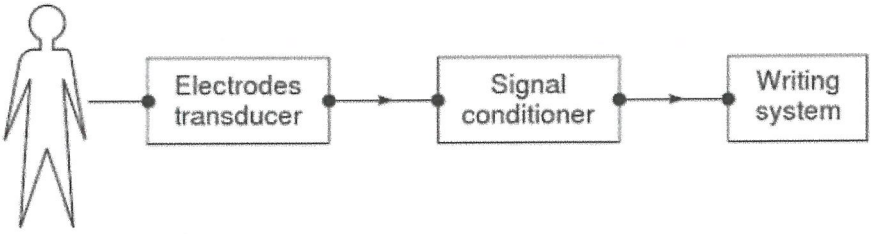

Figure Q3 (a)

SOLUTION

(b) Bioelectric measurement are basically low-level measurements, typically ranging between 1 μV and 100 mV. Discuss **FOUR (4)** basic requirements that a biopotential amplifier must satisfy when amplifying signals from human body.

(8 marks)

SOLUTION

(c) **Figure Q3 (c)** shows a schematic design of the main stages of a bioelectric potential amplifier. Analyze each component in **Figure Q3 (c)** to provide an optimum signal quality and adequate voltage level for further signal processing.

(11 marks)

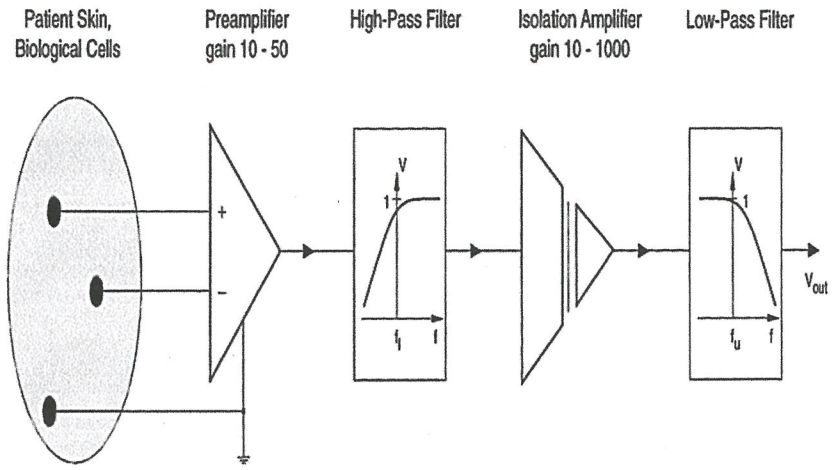

Figure Q3 (c)

SOLUTION

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Q4 (a) Predict **THREE (3)** major constraints which can be encountered while designing a measurement system for medical applications.

(6 marks)

SOLUTION

(b) Personal computer (PC) based medical devices are gaining popularity for several reasons including price, programmability and performance specifications offered. Illustrate and explain a typical configuration of a PC based medical device.

(12 marks)

SOLUTION

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(c) (i) List out **THREE (3)** advantages of wireless connectivity in medical devices.

(3 marks)

SOLUTION

(ii) Give and explain **ONE (1)** example of medical device that can be integrated with the Internet of Things (IoT).

(4 marks)

SOLUTION

- END OF QUESTIONS-