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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

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

**COURSE NAME : PRINCIPLE OF PHYSIOLOGICAL DEVICES**  
**COURSE CODE : BEU 30203**  
**PROGRAMME CODE : BEJ**  
**EXAMINATION DATE : DECEMBER 2019/JANUARY 2020**  
**DURATION : 3 HOURS**  
**INSTRUCTION : ANSWER ALL QUESTIONS  
PLEASE WRITE ALL THE ANSWERS ON  
THE QUESTIONS BOOKLET**

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**THIS QUESTION PAPER CONSISTS OF NINE (9) PAGES**

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**Q1** Electrodes are used to record the potential energy of human body, such as electrocardiogram (ECG). When electrodes are used to record the electrocardiogram (ECG), an electrolyte gel is usually put between them and the surface of the skin. This makes it possible for the metal of the electrode to form metallic ions that move into the electrolyte gel.

(a) Discuss the function of the other **SIX (6)** types of electrode.

(12 marks)

(b) Practical hints provide a various typical as well as specific experimental data and serve as a guide for daily laboratory work. Discuss **FOUR (4)** practical hints in using electrode.

(8 marks)

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- (c) One of the application of electrode is to measure the heart electrical activity or known as electrocardiogram (ECG). The normal pattern of ECG consists of *PQRST* elements. Elaborate each of the element.

(6 marks)

- (d) Identify the importance of measuring the electroencephalogram (EEG) and electromyogram (EMG) in diagnosis technology.

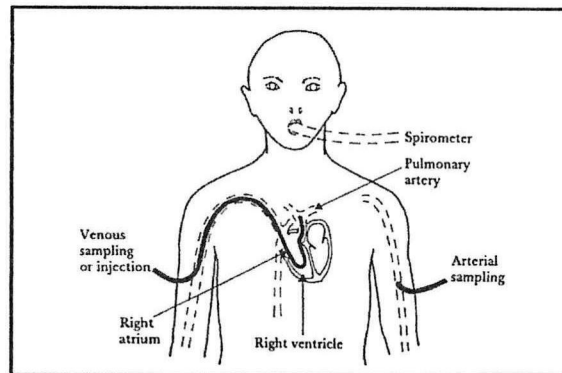
(8 marks)

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**Q2** The measurement of concentration of O<sub>2</sub> has several techniques that are easy to be applied; Fick technique, rapid injection, dye dilution, and thermal dilution.

- (a) **Figure Q2(a)** shows the Fick technique in measuring the cardiac output. Calculate the level of O<sub>2</sub> that spirometer could consume if the cardiac output was measured at 7 L/min, with arterial content = 150 ml/L and venous O<sub>2</sub> content = 130 ml/L.

(4 marks)



**Figure Q2(a)**

- (b) State **TWO (2)** factors that could be considered in dye dilution method when dye is injected into the pulmonary artery.

(4 marks)

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- (c) Explain the principle of thermal dilution method in measuring the cardiac output.  
Write the equation to calculate the cardiac output.

(4 marks)

**Q3** Biological sensor technologies provide contributions to the development and implementation of sensors for various applications used in medicine and biology.

- (a) Define the biological sensor and the principle that made up the sensor.

(4 marks)

- (b) Briefly explain **FOUR (4)** applications of biological sensor in current technology.

(8 marks)

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(c) List down **FOUR (4)** advantages of biosensor. (4 marks)

(d) Depending on the mechanism of transduction, biosensors could be classified into resonant biosensor, optical detection biosensor, thermal detection biosensor, and ion sensitive biosensor. Describe each of the type briefly. (8 marks)

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**Q4** Transducer is a device that converts energy into a corresponding signal with a different energy form which is comes from a sensor or an actuator.

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(a) Give definition on active and passive transducers.

(2 marks)

(b) Relate the application of transducer (sensor and actuator) in our society.

(4 marks)

(c) Differentiate the working principle of thermocouples and thermistor.

(8 marks)

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- (d) Thermistor usually has Negative Temperature Coefficients (NTC) which is the resistance,  $R$  of the thermistor decreases as the temperature,  $T$  increases. Derive the equation showing the temperature coefficient,  $\alpha$  is a nonlinear function.

(6 marks)

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- Q5** The ABC Corporation is a company specialized in the research, development and commercialization of innovative medical devices for therapy program aimed for assisting patients to recover from mental or physical ailment. The criteria of the devices that meet marketing need are low cost, low-risk, short time recovery, and effective usage (small size or portable). Design a simple medical device that fulfills the requirement.

(10 marks)

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**-END OF QUESTIONS-**