



UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017**

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COURSE NAME : MEDICAL MEASUREMENT SYSTEM
COURSE CODE : BEU 41003
PROGRAMME : BEJ
EXAMINATION DATE : DECEMBER 2016/JANUARY 2017
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS IN THIS QUESTION PAPER

THIS QUESTION PAPER CONSISTS OF TEN (10) PAGES

Q1 For the past few days, Mr. Lim felt pain and discomfort in the chest together with shortness of breath, and headache. Worried about his condition, he went to see a doctor. The doctor then performed two tests on Mr. Lim; one involving the reading of certain values, and the other one involving the reading of the signal.

- (a) Propose **TWO (2)** tests related to the heart that could be performed to diagnose Mr. Lim health condition. Explain why these tests are needed.

(4 marks)

Solution:

- (b) If the result of the test involving the signal turns out to be normal, draw and completely label the signal taken.

(5 marks)

Solution:

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- (c) **Figure Q1(c)** shows tracings of electrical activity and impulses created by the heart measured on an Electrocardiography (ECG). Analyse the condition of heart beat in all tracings.

(8 marks)

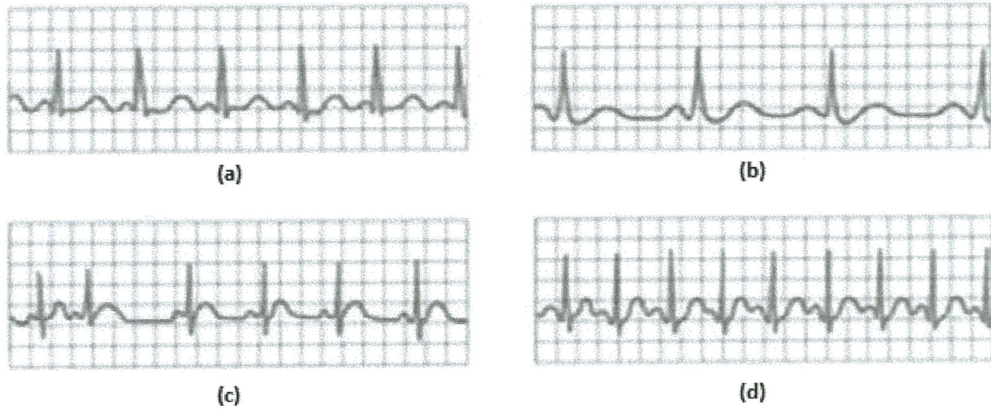


Figure Q1(c)

Solution:

- a =
- b =
- c =
- d =

- (d) The test involving the readings of certain values can be performed using a stethoscope or with an automatic oscillometric device.

- (i) Draw the method/model of the measurement for both methods.

(8 marks)

Solution:

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(ii) Explain the advantages and disadvantages of both methods.

(4 marks)

Solution:

(iii) If Mr Lim's blood pressure result turns out to be abnormal, propose **TWO (2)** possible blood pressure conditions and the blood pressure values.

(8 marks)

Solution:

Q2 Medical instrument is designed to measure various biomedical and physiological parameters.

(a) Define Photoplethysmography (PPG) technique.

(2 marks)

Solution:

(b) PPG signal is measured using a pair of light source and a photo detector.

(i) Illustrate the **TWO (2)** types of PPG placement mode.

(4 marks)

Solution:

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- (ii) Construct a table to compare the factors of measurable site, signal intensity and noise level between Transmission and Reflectance PPG. (6 marks)

Solution:

- (iii) Both Transmission and Reflectance mode PPG can be placed on the finger. Discuss which mode is better. Justify your answer. (4 marks)

Solution:

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- (c) Design the **EIGHT (8)** stages signal processing unit block diagram required in obtaining PPG output signal from KL 72001 main unit connected with PPG module. (8 marks)

Solution:

- (d) (i) Figure **Q2(d)(i)** shows the block diagram of respiratory ventilation measurement system used to measure the respiration. Complete the system by filling in the blank of the block diagram. (5 marks)

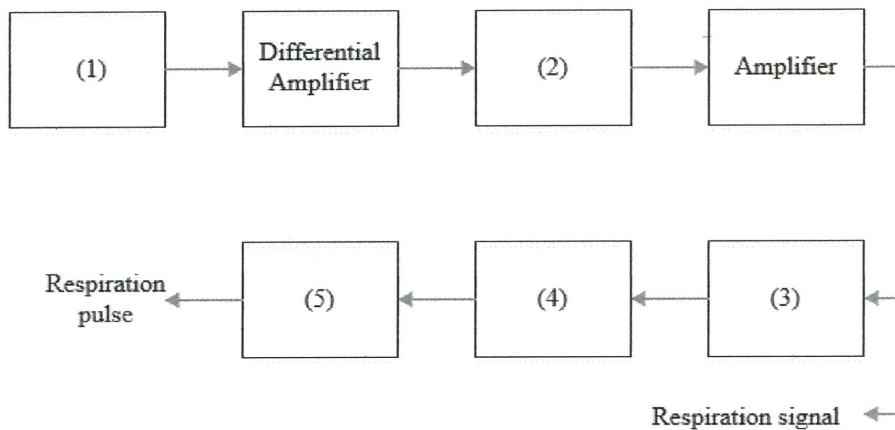


Figure Q2(d)(i)

Solution:

- 1 =
- 2 =
- 3 =
- 4 =
- 5 =

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- (ii) Explain the function of each stage of respiratory ventilation measurement system based on block diagram in **Figure Q2(d)(i)**.

(7 marks)

Solution:

- Q3** (a) Pulse measurement using KL 72001 main unit is conducted by placing the strain gauge sensor over the superficial radial artery at the wrist and wrapped with the wrist – type cuff as shown in **Figure Q3(a)**.

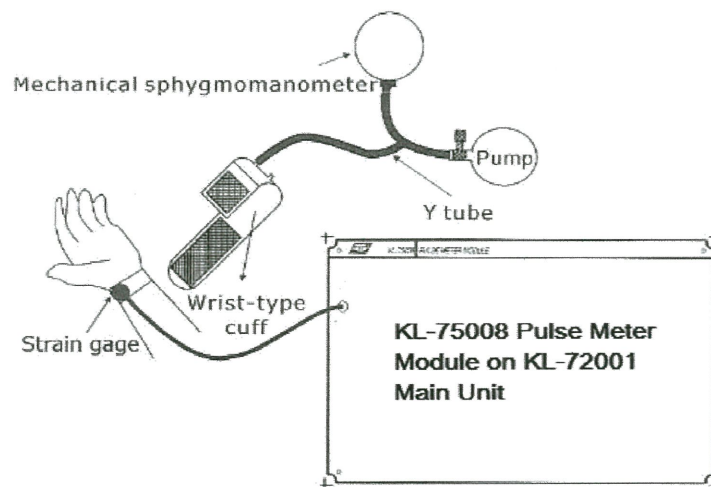


Figure Q3(a)

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- (i) By the aid of appropriate figures, differentiate the characteristic curve between band pass filter and band reject filter that are used to filter the pulse signal. Label clearly the axis of the graphs.

(8 marks)

Solution:

- (ii) Identify **TWO (2)** circuits to use if a synchronised output pulse is required.

(4 marks)

Solution:

- (iii) Indicate another medical measurement system that can be used to obtain pulse measurement.

(2 marks)

Solution:

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- (b) Human tissue is electrolyte-like and its main impedance effect is the capacitive reactance. Therefore, an AC constant current source is applied to the body to obtain a potential signal proportional to the body impedance. Propose a complete block diagram of body impedance measurement to observe the body impedance plot. (9 marks)

Solution:

- (c) A steady-state stimulus is acquired if the stimulation duration is twice its threshold value.
- (i) State the stimulus duration values applied in body impedance measurement for nerve tissue and smooth muscles. (2 marks)

Solution:

- (ii) Calculate the minimum frequency applicable in body impedance measurement on nerve tissue. (2 marks)

Solution:

-END OF QUESTIONS -