

**SULIT**



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN  
JABATAN PENDIDIKAN POLITEKNIK  
KEMENTERIAN PENDIDIKAN TINGGI**

**JABATAN KEJURUTERAAN ELEKTRIK**

**PEPERIKSAAN AKHIR**

**SESI 2 2016/2017**

**BEU4133 : BIOMEDICAL INSTRUMENTATION & MEASUREMENT**

**TARIKH : 13 JUN 2017**

**MASA : 9.00 PAGI -12.00 TGH (3 JAM)**

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Kertas ini mengandungi **ENAM (6)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Tiada

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**

**INSTRUCTION:**

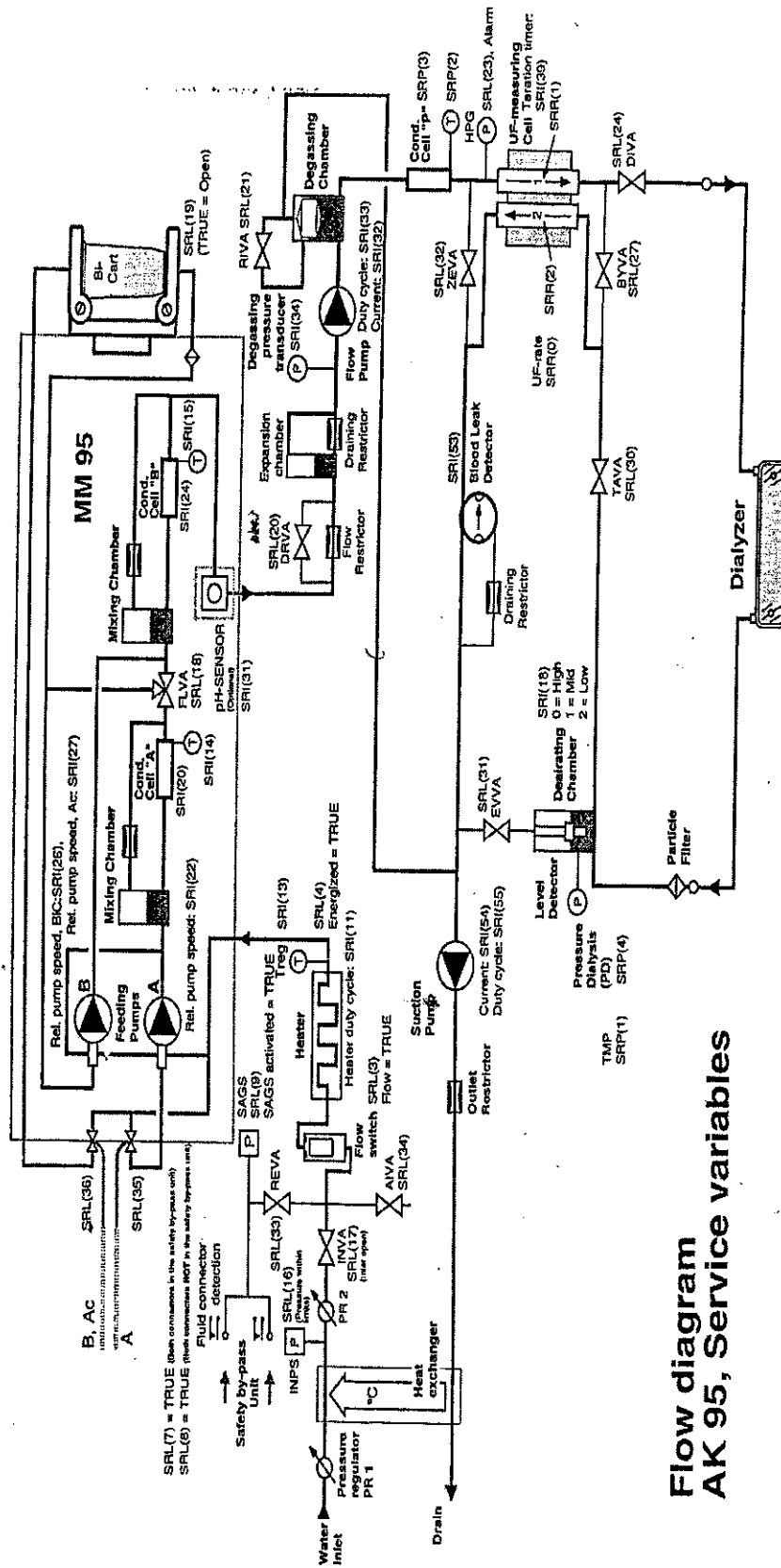
This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

**ARAHAN:**

*Bahagian ini mengandungi EMPAT (4) soalan berstruktur. Jawab SEMUA soalan.*

**QUESTION 1****SOALAN 1**

- |            |  |                           |
|------------|--|---------------------------|
| CLO1<br>C2 | a) Explain <b>FOUR (4)</b> sources of biomedical signals.<br><i>Nyatakan EMPAT (4) sumber isyarat biomedical.</i>  | [4 marks]<br>[4 markah]   |
| CLO1<br>C3 | b) Illustrate the flowchart for a design process of medical instrumentation system.<br><i>Lukiskan carta alir bagi process rekabentuk Pengukuran System Peralatan perubatan.</i>                 | [8 marks]<br>[8 markah]   |
| CLO1<br>C4 | c) Explain the circuit operation of hemodialysis machine AK95 based on the block diagram in <b>Figure 1</b> .<br><i>Huraikan operasi litar bagi mesin Hemodialysis AK 95 berdasarkan Rajah 1</i> | [13 marks]<br>[13 markah] |



Flow diagram  
AK 95, Service variables

Figure 1/ Rajah 1

## QUESTION 2

## SOALAN 2

CLO1  
C2

a) Blood pressure reading for a patient A is 127/65 mmHg.

Give the value of

*Bacaan tekanan darah bagi pesakit A ialah 127/65. Berikan nilai bacaan bagi*

i. Diastolic reading

ii. Systolic reading

iii. MEAN (MAP) reading

[4 marks]

[4 markah]

CLO1  
C3

b) Illustrate intrathoracic Lung Volumes and Capacities during inspiration and expiration.

*Gambarkan pengukuran Volume dan Kapasiti dalam intrathoracic semasa proses pernafasan dan penghembusan.*

[8 marks]

[8 markah]

CLO1  
C4

c) Pneumotachograph is an apparatus to record the rate of airflow to and from the lungs. It also used to measure gas flow rates during breathing by recording pressure differences across a device of fixed-flow resistance, known as pressure flow characteristics. Explain the measurement procedure for Fleisch types of Pneumotachographs.

*Pneumotachograph adalah peralatan untuk rakaman kadar aliran udara ke dan dari paru-paru. Ia juga digunakan untuk mengukur kadar aliran gas semasa bernafas dengan merekodkan perbezaan tekanan merentasi peranti rintangan tetap aliran yang dikenali ciri-ciri aliran tekanan. Terangkan prosedur pengukuran untuk jenis Fleisch daripada Pneumotachographs*

[13 marks]

[13 markah]

## QUESTION 3

## SOALAN 3

CLO2  
C3

- a) List types of surface electrode.

[4 marks]

*Senaraikan jenis-jenis electrode permukaan.*

[4 markah]

CLO2  
C4

- b) With the aid of diagram explain unipolar limb lead by Wilson technique.

[8 marks]

*Dengan bantuan gambarajah terangkan sambungan litar bagi Wilson teknik.*

[8 markah]

CLO2  
C5

- c) Design an electrical model for a specific biopotential electrode studies in the laboratory. The electrode is characterized by placing it in a physiological saline bath in the laboratory, along with an Ag/AgCl electrode having a much greater surface area and a known half-cell potential of 0.233 V. The dc voltage between the two electrodes are measured with a very-high-impedance voltmeter and found to be 0.572 V with the test electrode negative. The magnitude of the impedance between two electrodes is measured as a function of frequency at very low currents as **Figure 2**. From these data, suggest a circuit model for the electrode.

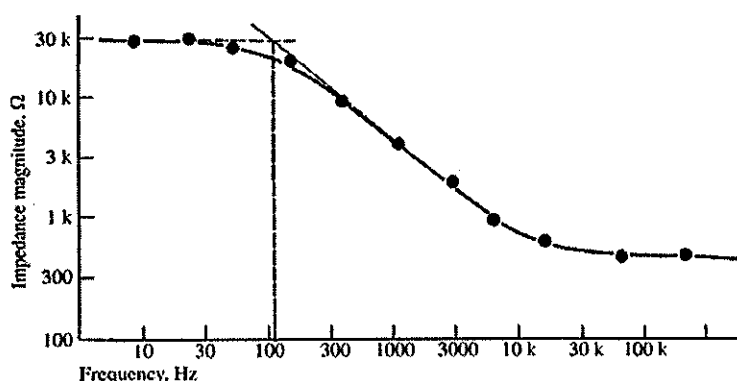


Figure 2

[13 marks]

[13 markah]

## QUESTION 4

## SOALAN 4

CLO2  
C3

- a) Distinguish the colour codes for the standard differential leads lead system for ECG electrode.

[4 marks]

*Kenal pasti kod warna piawaian bagi electrode ECG.*

[4 markah]

CLO2  
C4

- b) Consider the ECG amplifier shown in Figure 3. Calculate the output voltage  $V_o$ . [Note: the input voltages are  $V_1 = 1.2\text{mV}$  and  $V_2 = 3\text{mV}$ ].

*Pertimbangkan penguat ECG yang ditunjukkan . Kirakan voltan keluaran  $V_o$ . [Nota: voltan input adalah  $V_1 = 1.2\text{mV}$  dan  $V_2 = 3\text{mV}$ ].*

[8 marks]

[8 markah]

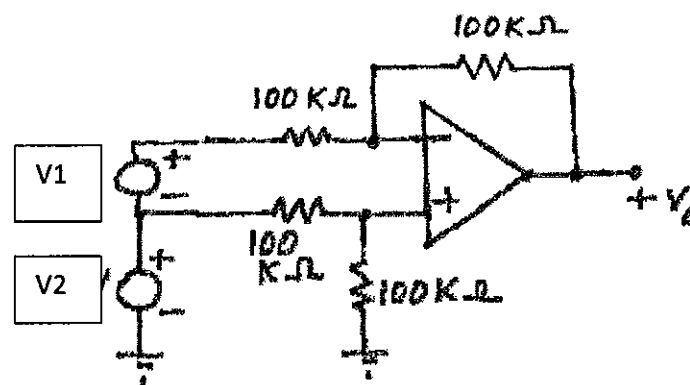


Figure 3

CLO2  
C5

- c) Differentiate between macroshock and microshock hazards

[13 marks]

*Bezakan antara bahaya 'macroshock' dengan 'microshock'*

[13 markah]

SOALAN TAMAT