



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN MEDICAL ENGINEERING

EBL 4403: BIOMEDICAL INSTRUMENTATION II. (PAPER 1)

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2024 TIME: 2 HOURS. DATE: AUGUST 2024.

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Attempt the compulsory question one and any other two.

Do not write on the question paper.

QUESTION ONE.

(a)(i). Define a biomedical instrument and mention any two examples of bio-medical instruments.

(ii) Explain the significance of a bio-sensors in medical instruments.

(iii). Explain why active bio-sensors are more preferable to passive sensors in electronic detection circuits.

(iv). Explain the meaning of the following terms as used with medical measurements.

(I). Sensitivity. (II). Accuracy. **(11 Marks).**

(b)(i). State the meaning of a thermistor and mention any two of its applications.

(ii). Explain why thermistors are more preferable in construction of medical thermometer than thermocouples.

(iii). Using a basic diagram, explain how a thermistor may be operated as a thermometer. **(10 Marks).**

(c)(i). Differentiate between a bio-signal and an electrical signal.

(ii). State the role of a bio-transducer in bio-signal measurements.

(iii). Explain any two advantages of converting bio-signals into electrical signals. **(9 Marks)**

QUESTION TWO.

(a)(i). State the meaning of a bio-sensor and role it plays bio-measurements system.

(ii). Explain the meaning of the following terms as related to bio-sensors.

(I). Analyte. (II). Bio-receptor

(ii). Explain need for human body temperature measurements. **(8 Marks).**

(b)(i). Explain the following bio-signals characteristics and mention one example of each signal.

(I). Permanent Bio-signals (II). Induced Bio-signals

(ii). Explain how Bio-magnetic signals differ from and bio-mechanical signals. **(7 Marks).**

(c). (i). Define the following popular types of bio-signals.

(I). Electro Myo Graphy, (EMG). (II). Electro Oculo Graphy, (EOG).

(ii). State the meaning of ECG electrodes and their application. **(5 Marks).**

QUESTION THREE.

(a)(i). Define Thermometry. State any two types of clinical thermometers.

(ii). State any two disadvantages of using of glass housed thermometers.

(iii). With the aid of a diagram, explain the operation of a clinical thermometer. **(13 Marks).**

(b)(i). Define an infra-red thermometer, hence explain how it used to measure temperature.

(ii). Mention any two advantages of using infra-red thermometers in hospitals. **(7 Marks).**

QUESTION FOUR.

(a) (i). Define instrumentation measurement system, hence state the need for bio medical measurement systems.

(ii). Draw a block diagram of an instrumentation system and explain how it simplifies signal measurements.

(iii). Explain the functions of the following measurements elements.

(I). Primary sensing Element. (II) Data Presentation Element. **(10 Marks).**

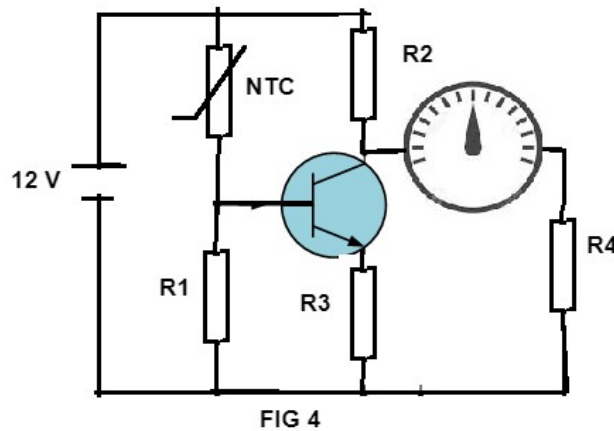
(b)(i). Define a thermocouple, hence explain why it is categorized as an active device.

(ii). Mention any two examples of passive transducers. **(4 Marks).**

(c). (i). Identify the circuit of Fig Q 4 and explain its operation.

(ii). Name one industrial application of the circuit.

(6 Marks).



QUESTION FIVE.

(a)(i). Define a measurement meter and differentiate between analogue and digital meters.

(ii) State any two advantages of using digital meters over analogue meters in bio-signal measurements.

(iii). Explain the meaning of the following terms as used with measurement meters.

(I). Precision. (II). Linearity.

(8 Marks).

(b)(i). State any two advantages of using a recording over indicating meters in measurements.

(ii). Draw and explain the construction and operation of a spiral bimetallic strip thermometer.

(iii). State any two advantages and two applications of spiral bimetallic thermometers.

(12 Marks).