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TECHNICAL UNIVERSITY OF MOMBASA

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SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

BACHELOR OF TECHNOLOGY IN ELECTRICAL ENGINEERING

TEE 4317: MEASUREMENT TECHNOLOGY (PP2)

SPECIAL/SUPPLEMENTARY EXAMINATION

**SERIES:** JULY 2025.

**TIME:** 2 HOURS.

**DATE:** July 2025.

**Instructions to Candidates**

The paper consists of five questions.

Answer any three Questions.

**Do not write on the question paper.**

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**Question One.**

(a)(i). Differentiate between a piezo electric generator and a thermistor hence explain why a thermistor is referred as a passive device.

(ii). State two advantages of transducing a non-electrical signal into an electrical type. **(10 Marks).**

(b)(i). Mention two advantages of using thermistors compared to thermocouples for constructing domestic thermometers.

**(ii).** Draw a basic thermistor based temperature indicating thermometer and explain how it functions.

(iii). A linear thermistor with resistance of  $10\ \Omega$  at  $30^{\circ}\text{C}$  and  $1480\ \Omega$  at  $90^{\circ}\text{C}$  is connected in series with a  $100\ \Omega$  and a 50V DC power supply. Calculate the two extreme temperature current and power dissipated across the fixed resistor. **(10 Marks).**

**Question TWO.**

(a)(i). Define a sensor, hence explain why a light dependent resistor is referred as a passive device.

(ii). Name any two types of active sensors. **(6 Marks).**

(b)(i). Explain the meaning of the following Basic Requirements of a Sensor.

(I). Linearity. (II) Accuracy.

(ii).With the aid of a diagram explain how a Tachogenerator can be used to construct a speedometer.  
(10 Marks).

(c). The circuit of figure Q 5 uses a thermistor whose resistance value is  $100\text{ K}\Omega$  at  $25^{\circ}\text{C}$  and  $100\text{ }\Omega$  at  $100^{\circ}\text{C}$ . Assuming a linear change in resistance, determine

The voltage drop across the thermistor and output voltage for the two extreme temperatures given the multiplication factor A as 5.  
(4 Marks).

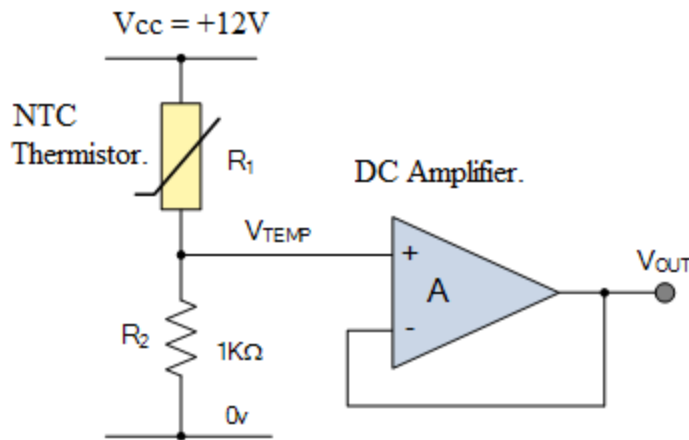


Figure 2

### Question THREE

(a)(i).Define heat measure measurements hence differentiate between Celsius and Fahrenheit temperature scales.

(ii).Explain the operational differences between a thermocouple and a thermostat.

(iii).State how an infrared thermometer differs from a clinical thermometer.  
(8 Marks).

(b)(i).With the aid of a diagram, explain how thermocouples can be used to measure heat energy.

(ii)State the principles of operation of a strain gauge sensor.

(iii).With the aid of a diagram, explain how a strain gauge sensor can be used to measure a tank water level.  
(12 Marks).

### Question FOUR.

a) (i). Define instrumentation measurements, hence state the functions of the following elements in a measurements system.

(I). Primary sensing element. (II) Variable conversion element.

(ii). Differentiate between a recording and an indicating instruments. **(8 Marks).**

(b)(i). Differentiate between active and passive instruments.

(ii). Mention any two examples of passive instruments. **(5 Marks).**

(c). (i). Draw and explain the operation of a simple water tank level indicator using a floater system.

(ii). Explain the meaning of the following terms as related to tank level indication.

(I). Accuracy. (II). Linearity. **(7 Marks).**

### **Question FIVE**

(a)(i). Define heat, hence state the function of a thermostat in a refrigerator operation.

(ii) Name any two types of heat sensors and how they operate. **(8 Marks).**

(b). (i). Draw and explain the construction and operation of a bi-metallic strip.

(ii). With the aid of a diagram, explain the operation of a light flasher using a bimetallic strip.

(iii). State any two advantages and disadvantages of bimetallic switches. **(12 Marks).**