



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

## UNIVERSITY EXAMINATION FOR:

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING

ECI 2203: MEASUREMENTS TECHNOLOGY 2

## END OF SEMESTER EXAMINATION

**SERIES:** AUGUST 2019

**TIME:** 2 HOURS

**DATE:** AUGUST 2019

### Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This 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 heat and temperature hence state any two types of thermometers for industrial application.

(ii). Explain the following modes of heat energy transfer.

(I). Convection. (II) Radiation. **(5 Marks)**.

(b) (i). Explain how a Celsius scale thermometer differ from a Fahrenheit scale type.

(ii). State the following International System of Units (SI) for heat.

(I). British thermal unit (Btu) (II). Kilocalorie (kcal). **(5 Marks)**.

(c) (i). With the aid of a basic diagram, explain the construction and operation of a clinical thermometer.

(ii). A certain liquid's temperature was 32 degrees centigrade at the start of a chemical process. It was observed that the liquid temperature shot to 58 degrees centigrade. Calculate the upper and the lower scale reading for a Fahrenheit scale thermometer. **(10 Marks)**

## Question Two

(a) (i).Distinguish between volumetric and mass flow, hence state any two precautions to be taken when taking gas flow rate measurements.

(ii).State the meaning of the following terms as employed with fluid measurements devices.

(I).Accuracy (II).Repeatability. **(8 Marks)**

(b) (i).State any two advantages of using positive displacement flow meters for fluid measurements.

(ii).With the aid of elaborative diagrams, explain how positive displacement oval gear flow meters operates.

**(7 Marks)**

(c). An oval gear flow meter system displaces a quantity of 20 milliliters per full cycle. The system rotates at a rate of 20 cycles per second. Determine,

(I).The total volumetric rate per second (II).The total fluid price given the flow time to be 5 minutes and the fluid price to be Ksh. 109/= per liter. **(4 Marks)**

## Question Three

(a) (i). Explain the significance of temperature measurements in industrial processes.

(ii).State the role of heat sensors in industrial heating systems and explain how the following sensors behave when subjected to a changing temperature environment.

(I).Bi-metallic sensor. (II).Resistive sensors.

(iii).Explain the importance of telemetry in industries. **(10 Marks)**

(b) (i). Explain the operational difference between a thermo couple and infrared thermometers.

(ii).State any two advantages and disadvantages of bimetallic thermometers.

(iii).With the aid of a diagram, explain the construction and operation of a helical bi metallic element thermometers. **(10 Marks)**

## Question Four

(a) (i).Define a pyrometer and explain how it differs from an Resistance Temperature Detector, RTD.

(ii).State any two advantages of optical pyrometers compared to RTDs. **(5 Marks)**

(b). (i).State the significance of the pyrometers lens.

(ii).With the aid of a diagram, explain the construction and operation of an optical pyrometer. **(12 Marks)**

(c).The thermistor used in figure Q4 has a resistance value of  $15\text{K}\Omega$  at  $25^\circ\text{C}$  and  $120\Omega$  at  $100^\circ\text{C}$ . Calculate the output voltage of the circuit for both temperatures when connected in series with a  $1\text{k}\Omega$  resistor across a  $12\text{v}$  power supply. **(3 Marks)**

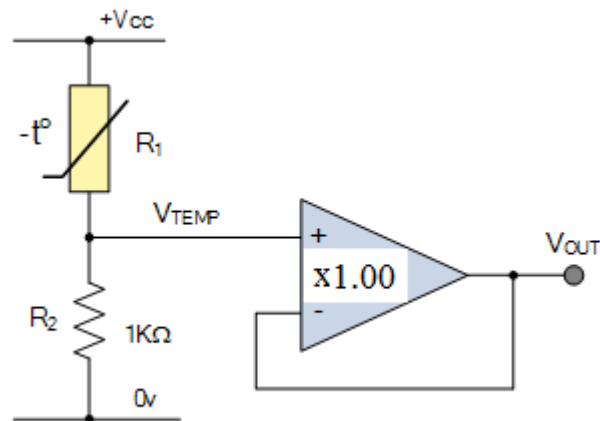


Figure Q 4

### Question Five

(a) (i).State faraday's law induction law and explain its significance in sewage water flow measurement.

(ii). Define a flow meter and explain the roll of a primary flow element in a flow meter. **(6 Marks)**

(b) (i).State any two considerations for selecting a flow meter.

(ii).Distinguish between an orifice plate and a flow switch, hence give applications of concentric orifice.

**(7 Marks)**

(c).With the aid of a diagram, explain the operation of an orifice flow meter. **(7 Marks)**