PP2

TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN ELECTRICAL ENGINEERING

TEE 4204: ELECTRICAL MEASUREMENTS (PP2)

END OF SEMESTER EXAMINATION

SERIES: MARCH 2025. **TIME:** 2 HOURS. **DATE:** MARCH 2025.

Instructions to Candidates

The paper consists of five questions.
Answer any three Questions.
Do not write on the question paper.

Question One

(a)(i). Define a transducer, hence state the meaning of active transducers.

(ii). Explain a thermocouple is referred as an active transducer. **(4 Marks).**

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(b)(i). State the operational difference between a thermistor and an LDR.

(ii). Using a basic bimetallic strip based diagram, explain how it can be used as a thermometer.

(iii). Name any two disadvantages of using bimetallic strips. **(16 Marks).**

Question TWO

(a) (i). State difference between the following permanent magnet parameters.

(I). Damping Force. (II). Full Scale Deflection.

(ii). Explain the role played by the following components of a moving coil meter.

(I). Multiplier Resistor. (II). Helical springs**.** **(8 Marks).**

(b)(i) State the effect of temperature change on resistance measurements.

(ii). With the aid of a well labeled diagram, explain the construction and operation of a permanent magnet moving coil meter. **(8 Marks).**

(c) (i). A moving coil meter has an internal resistance of 100 ohms and requires 10 milliamps for full scale deflection. Calculate the required component values to convert the meter to read,

(I).100 Ampere. (II).100 Volts. **(4 Marks).**

Question THREE

(a)(i)Define the following terms related to cathode ray tube.

(I). Beam deflection. (II). Fluorescence.

(ii)State the reason for evacuating a cathode ray tube. **(6 Marks).**

(b)(i). State any two applications of a cathode ray tube.

(ii). Draw and explain the operation of a cathode ray tube. **(10 Marks).**

(c). A 100-ohm resistor is measured with a cathode ray oscilloscope which displays two complete cycles on the screen. Two of the controls are set at 4 micro second /cm and 5 volts/cm. If the waveform covers 2cm both vertically and horizontally, determine the following.

(I). The voltage across the resistor. (II). Power dissipated by the resistor. **(4Marks).**

Question FOUR

(a)(i). Explain why AC bridges are more superior in electrical measurements compared to avometers.

(ii). States any two merits of an AC bridge compared to a volt meter.

(iii). Explain why LED lamps cannot be used with AC bridges as detectors. **(7 Marks).**

(b). (i). Identify the circuit of figure Q4 and derive the equations for determining the values of inductor L_4 and resistance R_4 at balance.

(ii). At balance, the components value for each arm are given as below.

Arm AD, $R_1 = 1000\Omega$ and $C_1=0.5\mu F$. Arm AB, $R_2= 600\ \Omega$. Arm DC, $R_3 =400\ \Omega$.

Calculate the values for L_4 and R_4

(II). The value of current flowing through arm ABC. **(13 Marks).**

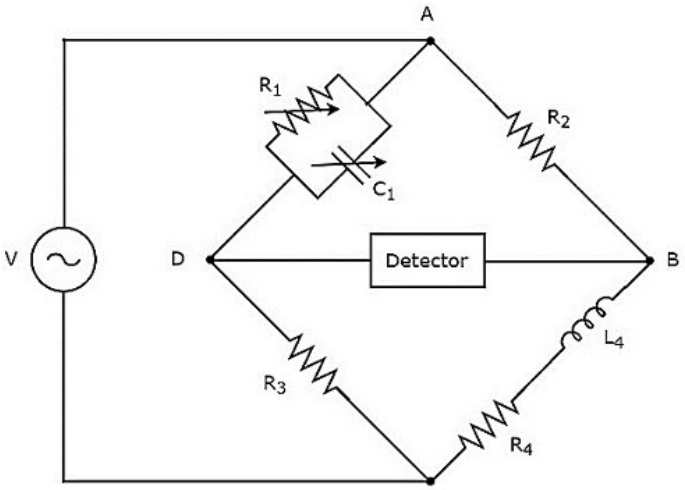

Figure Q 4

Question FIVE

(a)(i). Differentiate between a sensor and a transducer, hence mention one example for each.

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

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

(I). Accuracy. (II) Sensitivity.

(ii). With the aid of a diagram explain how an RTD can be used with an analogue meter to measure different temperatures. **(10 Marks).**

(c). The circuit of figure Q5 uses a thermistor whose resistance value is 15 KΩ at 20°C and reduces to 200Ω at 100°C. Calculate the voltage drop across the thermistor and hence circuit output voltage for both temperatures if the amplifier A has a gain of 25. **(4 Marks).**

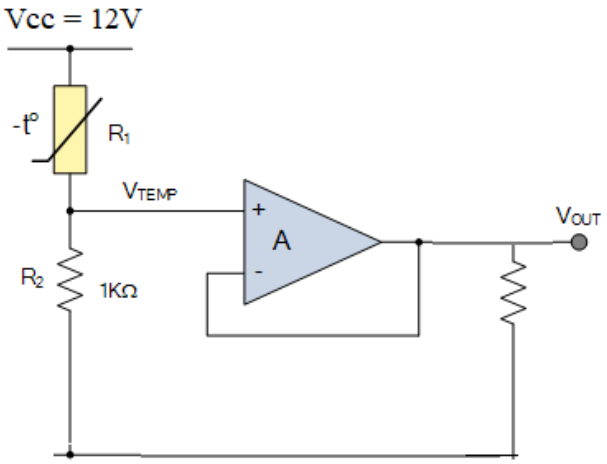

Fig Q 5