

(PP1)



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN ELECTRICAL ENGINEERING

EEE 4404: INSTRUMENTATION. (PP1)

END OF SEMESTER EXAMINATION

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

Instructions to Candidates

The paper consists of five questions.

Answer Compulsory question one and any two Questions.

Do not write on the question paper.

Question ONE

- (a)(i). (i). Differentiate between a thermostat and a thermistor.
- (ii). Mention any two demerits of using thermistors in constructing thermometers.
- (iii). A thermistor which has a resistance of $20\ \Omega$ at 30°C and $1480\ \Omega$ at 80°C is connected in series with a fixed resistor of $100\ \Omega$ and a 50V DC power supply. Calculate,
- (I). The potential differences across the resistor for the two temperatures.
- (II). Power dissipated difference across the fixed resistor. (Assume a linear thermistor). **(10 Marks).**
- (b)(i). Define a resistive transducer.
- (ii). Name any two applications of resistive transducers.
- (iii). Draw a simple resistive transducer and explain how it can be used to transform mechanical energy into electrical energy. **(10 Marks).**
- (c)(i). Define a sensor and explain the role of a sensors in measurements instruments.
- (ii). State the advantages of using self-generating sensors in electronic circuits.
- (iii). Using a resistor and a DC power supply and a galvanometer, explain how a light dependent resistor (LDR) can be used as an illumination meter. **(10 Marks).**

Question TWO

- (a)(i). Explain the meaning of transducer, hence differentiate between a passive and an active transducer.
- (ii). Name any two examples of active transducers and their industrial applications.
- (iii). State two advantages of transducing a non-electrical signal into an electrical type. **(9 Marks).**
- (b)(i). State the operational difference between a solar cell and a photo resistor.
- (ii). Identify the circuit of Fig Q 2 and explain its operation.
- (iii). Explain the effect of a permanent break down of the photo resistor on circuit performance.
- (iv). Calculate the bulb and the fixed resistance current when the transistor is fully conducting.
- (11 Marks).**

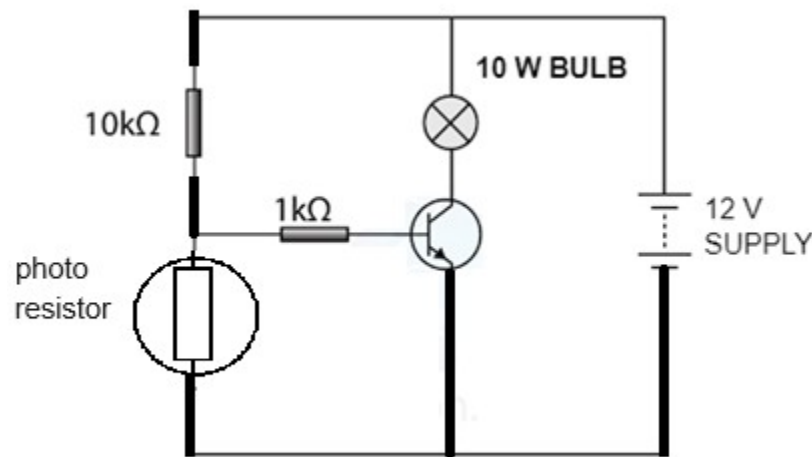
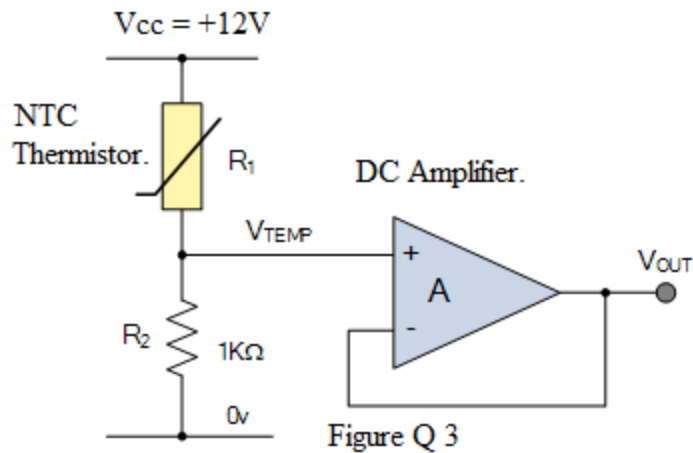


FIG Q 2

Question THREE

- (a)(i). Explain why a thermocouple is referred as an active transducer, hence name any two of its applications.
- (ii). Name the parts of a transducer and their functions.
- (iii). State two disadvantages of using a thermocouple in heat measurements. **(7 Marks).**
- (b). (i). Differentiate between a thermostat and a thermistor.
- (ii).** Draw a basic thermostat based light flasher system and explain its operation. **(9 Marks).**
- (c). The circuit of figure Q 3 uses a thermistor whose resistance value is $10\text{ K}\Omega$ at 25°C and $100\ \Omega$ at 100°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 2. **(4 Marks).**



Question FOUR.

- (a)(i). Define a piezo electric material and state any two of its applications.
- (ii) Differentiate between an indicating and a recording instruments. (9 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 spiral strip bimetallic thermometer.
- (iii). State any two advantages and disadvantages of bimetallic strip thermometers. (11 Marks).

Question FIVE.

- (a) (i). Define instrumentation, hence state the need for instrumentation in industries.
- (ii). Draw a block diagram of an instrumentation system and explain the functions of the following blocks.
- (I). Signal transmission element. (II). Signal presentation element. (9 Marks).
- (b)(i). Differentiate between active and passive instruments.
- (ii). Mention any one example of active and passive instruments. (4 Marks).
- (c). (i). Explain the operational difference between analogue and digital instrumentation systems.
- (ii). Explain the meaning of the following terms as related to measuring instruments.
- (I). Sensitivity. (II). Repeatability. (7 Marks).