



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 (PP1)

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2024. TIME: 2 HOURS. DATE: AUGUST 2024.**Instructions to Candidates**

The paper consists of five questions.

Answer any three Questions.

Do not write on the question paper.

Question One

(a)(i). Differentiate between a sensor and a transducer, hence state the meaning of active transducers.

(ii). Explain how a positive coefficient thermistor operates.

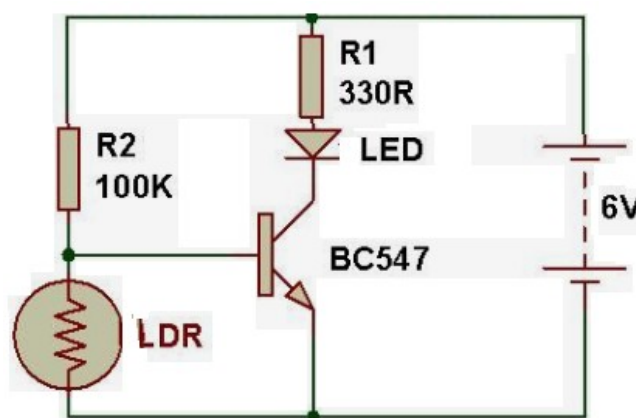
(iii). Explain why a solar cell is referred as an active sensor and state one commercial application of solar cells.
(8 Marks).

Figure Q 1

(b)(i). State the operational difference between a bimetallic strip and a thermostat.

- (ii). Identify the circuit of Fig Q 1 and explain its operation.
- (iii). Explain the effect of a permanent break down of the light dependent resistor on the circuit.
- (iv). Calculate the full light emitting diode current and its power rating. **(12 Marks).**

Question TWO

- (a)(i). Define a Permanent Magnet Moving Coil instrument, (PMMC).
- (ii). State any two advantages and disadvantages of a PMMC instrument. **(6 Marks).**
- (b) (i). With the aid of a diagram, explain the construction and operation of a galvanometer.
- (ii). Derive the PMMC Torque Equation and show the relationship between coil current and coil deflection. **(12 Marks).**
- (c). A PMMC instrument has a coil of dimensions 15 mm by 12 mm. The flux density in the air gap is $1.8 \times 10^{-3} \text{ Wb/m}^2$ while the spring constant is $0.14 \times 10^{-6} \text{ Nm/degree}$. If the required angular deflection is 90 degrees and the coil has a winding of 100 turns, calculate, for a current of 5 mA, (I). Deflecting Torque. (II). Controlling Torque. **(2 Marks).**

Question THREE

- (a)(i). Explain the meaning and function of the following components as related to cathode ray tube.
 - (I). Control grid. (II). Fluorescent screen.
- (ii). State the reason that causes the Fluorescent screen to become warm when the cathode ray tube is in operation. **(6 Marks).**
- (b)(i). Explain why the cathode ray tube has to be made of strong thick walled glass.
- (ii). Draw and explain the operation of a cathode ray tube. **(11 Marks).**
- (c). A signal generator is connected to an oscilloscope and presents a 2.5 cycles sinusoidal waveform on its screen covering 5 centimeters horizontally. The peak to peak amplitude of the covers 4 centimeters vertically. If the vertical and horizontal sensitivities are set at 5V/cm and $2\mu\text{s/cm}$, calculate,
 - (I). Peak amplitude (II). Periodic time and frequency. **(3 Marks).**

Question FOUR

- (a)(i). Differentiate between an inductive impedance and capacitive reactance in electrical measurements.
- (ii). States any two merits of an AC bridge compared to a volt meter.
- (iii). Name any two devices that can be used with AC bridges as detectors. **(8 Marks).**

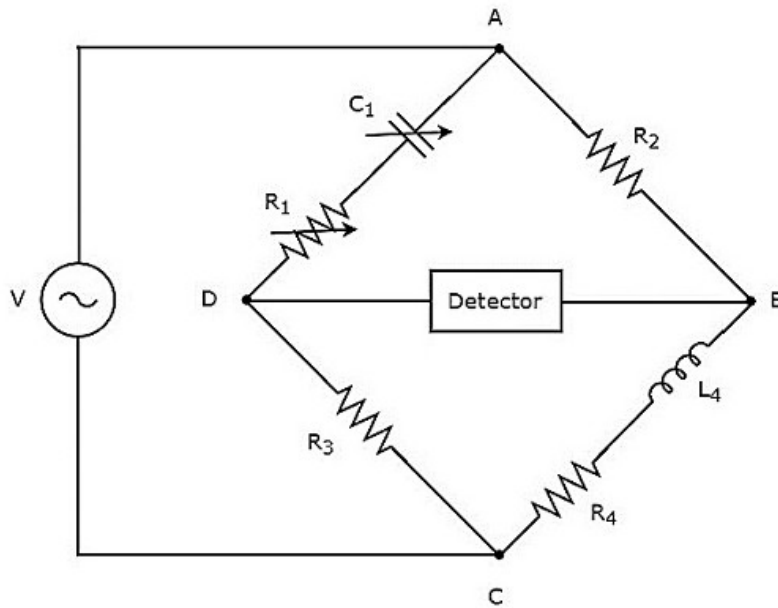


FIG Q 4

(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). Given Arm DA to be a non-inductive resistance of $880\ \Omega$ in series with a capacitor of $1.4\ \mu\text{F}$, Arm AB to be $16500\ \Omega$, and Arm CD to be $1000\ \Omega$, find the following if the supply voltage is 250V at a frequency of 50Hz , determine,

(I). The values of Resistance R_4 and inductance L_4 .

(II). The value of current flowing through arm ADC.

(12 Marks).

Question FIVE

(a) (i). Define instrumentation, hence state the need for instrumentation in industries.

(ii). Draw a labeled block diagram of an instrumentation system, hence explain the functions of the following element blocks.

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

(10 Marks).

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

(ii). Mention any two examples of passive instruments.

(4 Marks).

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

(ii). Explain the meaning of the following terms as related to measuring instruments.

(I). Accuracy. (II). Linearity.

(6 Marks).