MACHAKOS UNIVERSITY

University Examinations for 2023/2024 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

SECOND YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (CLOUD COMPUTING)

SCC 202: SENSORS PRINCIPLES & APPLICATIONS

DATE: **TIME:**

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSARY) THIRTY MARKS

a) As used in science and technology, define measurement (1 mark)

b) With reference to measurements of physical quantities, differentiate between sensor and transducer (2 mark)

c) Outline the three basic requirements for the results of measurements to be meaningful and valid (2 marks)

d) As factors to consider in sensor selection, explain:
   i. Accuracy (2 mark)
   ii. Precision (2 marks)

e) Differentiate between error and noise in measurement systems (2 marks)

f) List four types of sensors based on input quantity measured (4 marks)

g) Direct and indirect are methods of physical quantities measurement, explain the differences between the two methods (4 marks)

h) With the aid of diagrams, explain the difference between positive temperature coefficient and negative temperature coefficient in materials (4 marks)

i) List two types of thermo-resistive measuring devices (2 marks)

j) A given electrical conductor used in the fabrication of a thermocouple has a resistance of 2Ω at 40°C and 5Ω at 100°C. Determine the resistance of the conductor at 0°C (5 marks)

QUESTION TWO (20 MARKS)

a) With the aid of a circuit diagram, show how unknown resistance can be measured using a Wheatstone bridge (6 marks)

b) With the aid of a diagram, describe temperature measurement using thermocouple (6 marks)

c) Differentiate between digital and analogue sensors (4 marks)

d) State the two basic components of a photoelectric sensor (2 marks)

e) State two applications of thermocouples (2 marks)

QUESTION THREE (20 MARKS)

a) Define calibration as used in measurement systems (1 mark)
b) Briefly discuss the need for calibration and when it is necessary in measurement systems (5 marks)
c) Outline two applications of a photodiode (2 marks)
d) With reference to variable capacitance phenomena, describe the operation of pressure sensing device (5 marks)
e) Differentiate between sensitivity and repeatability as used in measurement systems (4 marks)
f) Describe signal conditioning and its importance in instrumentation system (3 marks)

QUESTION FOUR (20 MARKS)

a) Define unit of measurement (1 mark)
b) Explain the basic principle of operation of photodiode as an optical sensor (5 marks)
c) Differentiate between static and dynamic sensor characteristics (4 marks)
d) Discuss the significance of measurement systems in relation to science and technology (5 marks)
e) Describe the basic principle of operation of a photoelectric sensor (5 marks)

QUESTION FIVE (20 MARKS)

a) Ultrasonic sensor is used to detect movement of an object within a given confine, briefly explain how motion of an object is realised using this technique. (5 marks)
b) With the aid of a block diagram, describe a basic measurement system (6 marks)
c) Describe the principle of operation of a motion detector using infrared waves (6 marks)
d) Outline three applications of thermistors (3 marks)