MACHAKOS UNIVERSITY

University Examinations for 2022/2023

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) With reference to measurements of physical quantities, define:

i. Sensor **(**1 mark)

ii. Transducer (1 mark)

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

c) As factors to consider in sensor selection, explain:

i. Resolution (2 marks)

ii. Accuracy (2 marks)

iii. Precision (2 marks)

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

e) List three types of sensors based on input quantity being measured (3 marks)

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

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

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

i) A given electrical conductor used in the fabrication of a thermocouple has a resistance of 3Ω at 50°C and 4Ω at 100°C. Determine the resistance of the conductor at 0°C (5 marks)

QUESTION TWO (20 MARKS)

a) With the aid of a diagram, describe temperature measurement using:
   i. Thermocouple (6 marks)
   ii. RTD employing a resistive bridge network (6 marks)

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

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

d) State two applications of thermocouples (2 marks)

QUESTION THREE (20 MARKS)

a) Define calibration as used in measurement systems and briefly discuss the need for calibration and when it is necessary in measurement systems (6 marks)

b) Outline three applications of a photodiode as an optical sensor (3 marks**)**

c) With reference to variable capacitance phenomena, describe the operation of pressure sensing device (6 marks)

d) Differentiate between sensitivity and repeatability (4 marks)

e) Define signal with reference to sensors (1 mark)

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 measure the reflection of a moving 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 ultrasonic waves (6 marks)

d) Outline three applications of thermistors (3 marks)