UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UCTATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BMT 3022
COURSE	: SENSOR TECHNOLOGY
SEMESTER/SESSION	: 2-2023/2024
DURATION	: 2 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **ALL** questions
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 5 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) A sensor is a device that receives a stimulus and responds with an electrical signal. Describe meaning of '*stimulus*' with an example. (3 marks)

b) Transducer is a converter of one type of energy into another. Transducer may be used as actuator.

i. Explain the difference between transducers and primary sensors. (4 marks)

ii. Describe the function of an actuator. (4 marks)

iii. Give an example of application of actuator in our daily life. (2 marks)

c) Explain the characteristic of a sensor below.

i. Accuracy (2 marks)

ii. Calibration (2 marks)

iii. Reliability (2 marks)

iv. Repeatability (2 marks)

v. Hysteresis (2 marks)

QUESTION 2

a) Temperature is one of the most widely measured and controlled variable in industry, as a lot of products during manufacturing requires controlled temperature at various stages of processing.

i. Describe **THREE (3)** types of temperature transducers (12 marks)

ii. Explain with diagram the operation of 2 wire and 3 wire RTD. (6 marks)

b) Differentiate between thermistor and thermocouple. (6 marks)

c) Calculate the change in resistance of platinum resistance coil with 100Ω resistance at 25°C when the temperature is raised to 50°C. The temperature coefficient of resistance can be taken as 0.0039/0 °C. (7 marks)

QUESTION 3

a) The plates of a parallel capacitor have a separation of 2.85 mm, and each has an area of 10.2 cm^2. If a charge of 3.95 x 10^{-8} *C* is carried by each plate and the dielectric media between the plates is air, calculate:

i. Capacitance, *C* (6 marks)

ii. Potential difference, *V* between the plates. (4 marks)

iii. Magnitude of the electric field, *E* between the plates. (4 marks)

b) Design a water level sensing system based on capacitive sensing method.

i. Draw a block diagram of your water level sensing system. (1 mark)

ii. Explain its working principle. (6 marks)

c) Provide **TWO (2)** limitations of capacitive sensor and how to avoid them. (2 marks)

QUESTION 4

a) The strain gauge is an example of a passive transducer that uses the variation in electrical resistance in wires to sense the strain produced by a force on the wires.

i. Define the *strain gauge* and *gauge factor* of a resistance strain gauge. (4marks)

ii. Describe **THREE (3)** types of strain gauge. (6 marks)

b) Distinguish between bonded and unbonded strain gauges and their suitability for measurement of physical quantities. (6 marks)

c) A strain gauge has a resistance of 130Ω and a gauge factor of 2. Compute the change in resistance produced if the gauge is subject to a strain of 0.000001 (7 marks)

----------End of question----------