KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER
SUPPLENTARY EXAMINATIONS

FOR THE DEGREE OF B.SC (RENEWABLE ENERGY AND BIOFUELS TECHNOLOGY)

COURSE CODE: REN 327

COURSE TITLE: INSTRUMENTATION AND AUTOMATION

DATE: 24/11/2022 **TIME:** 11:00AM-1:00PM

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

Answer question ONE and any TWO of the remaining

KIBU observes ZERO tolerance to examination cheating

Question One (Compulsory)

a) Define the following: (3 marks)

i) Range

ii) Hysteresis

iii) Resolution

b) List **two** types of temperature transducers. (2 marks)

c) State **three** advantages of thermocouples. (3 marks)

d) Distinguish between the following: (4 marks)

i) Inverse transducers and active transducers

ii) Analogue and digital transducers

e) State **three** factors to be considered in the selection of a good transducer. (3 marks)

f) State **three** types of flow sensors. (3 marks)

g) Define what is meant by 'data acquisition system' (2 marks)

h) What are the uses of data acquisition systems? (3 marks)

i) State **three** advantages of using Programmable Logic Controllers (PLC) over electrical relays. (3 marks)

j) State the **four** stages of operation of a PLC. (4 marks)

Question Two

a) Describe each of the following types of errors. (8 marks)

i) Gross Errors

ii) Systematic Errors

b) The expected value of the voltage across a resistor is 80 V. However, the measurement gives a value of 79 V. Calculate (12 marks)

i) absolute error,

ii) percentage error,

iii) relative accuracy,

iv) percentage of accuracy

Question Three

a) With the aid of a diagram, describe the principle of operation of a thermocouple.

(6 marks)

b) With the aid of a diagram, explain the operation of galvanometer pen-chart recorder.

(6 marks)

c) With the aid of a diagram, explain the construction and operation of a liquid Crystal Display (LCD). (8 marks)

Question Four

a) With the aid of a block diagram, describe the components of data loggers. (6 marks)

b) With the aid of a block diagram, explain the process of computer data logging.

(8 marks)

c) A strain gauge with a gauge factor of a 2 is fastened to a metal and is subjected to a stress of 1000kg/cm^2. The Young's modulus of the metal is 2 × 10^6 kg/cm^2. Determine the percentage change in the resistance of the strain gauge. (6 marks)

Question Five

a) With the aid of a labelled block diagram, explain the functions of the elements of a Programmable Logic Controller (PLC) system. (10 marks)

b) Explain any **five** static characteristics of measuring instruments. (10 marks)