UNIVERSITY COLLEGE TATI (UCTATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: DEI 2012
COURSE TITLE	: INSTRUMENTATION & MEASUREMENT
SEMESTER/SESSION	: 2 - 2022/2023
DURATION	: 3 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 up 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) Knowledge of the performance characteristics of an instrument is essential for selecting the most suitable instruments for specific measuring jobs. State the difference between accuracy and precision of measurement. (3 marks)

b) Systematic Error is error occur due to shortcomings of the instrument. Give **THREE (3)** types of systematic errors. (6 marks)

c) The expected value of the voltage across a resistor is 60V. However, the measurement gives a value of 58V. Compute:

i. Absolute error (2 marks)
ii. % error (3 marks)
iii. Relative accuracy (3 marks)
iv. % of accuracy (2 marks)

d) A 300V voltmeter is specified to be accurate within ±2% at full scale. Compute the limiting error when the instrument is used to measure a 120V source?

(6 marks)

QUESTION 2

a) Calibration is the comparison of measurement values delivered by a device under test with a calibration standard accuracy.Describe the meaning of calibration uncertainty. (4 marks)

b) Describe the difference between test accuracy ratio (TAR) and test uncertainty ratio (TUR). (6 marks)

c) The accuracy of valve calibration affects the static performance and dynamic response of control valve. With aid of diagram describe the process of control valve calibration. (6 marks)

d) A valve positioner is a device used to increase or decrease the air load pressure driving the valve stem reaches the set point. Describe **THREE (3)** types of positioner. (9 marks)

QUESTION 3

a) Cavitation is a common phenomenon in control valve application. Describe the conditions that cause the cavitation. (5 marks)

b) Major components of a typical control valve are actuator and valve body. List **TWO (2)** basic functions of the actuator. (5 marks)

c) Two control valves calibration split range is show in Table 1.

Table 1

Control signal	Valve A	Valve B
4 mA	Fully closed	Fully closed
8 mA	50% open	Fully closed
12 mA	100% open	Fully closed
16 mA	100% open	50% open
20 mA	100% open	100% open

i. Calculate the stem position of each control valve at a signal value of 6.34 mA (3 marks)

ii. Calculate the stem position of each control valve at a signal value of 15.81 mA. (3 marks)

d) The three-valve manifold on a level transmitter must operated correctly either while removing the transmitter for service or returning it to service. Describe the operational sequences of three-valve manifold for installing and uninstalling the transmitter from line production. (9 marks)

QUESTION 4

a) Explain **TWO (2)** advantages and disadvantages of venturi flowmeter manometer. (5 marks)

b) Describe how the ambient pressure in a room containing a pressure transmitter can affect the reading of the transmitter. (4 marks)

c) A pressure measuring instrument is designed around a Bourdon tube. Explain how extreme changes in the ambient temperature of the Bourdon tube will introduce errors into the readings of the instrument. (4 marks)

d) Describe how each of the following devices are used to measure pressure.

i. Bourdon Tube (3 marks)
ii. Bellows (3 marks)
iii. Diaphragm (3 marks)
iv. Capsule (3 marks)

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