BACHELOR OF CHEMICAL ENGINEERING (3ᴿᴰ YR 2ˢᵀ SE EXAMINATION, 2023)

(1ˢᵗ /2ⁿᵈ-Semester Supplementary)

SUBJECT: - PRINCIPLES OF MEASUREMENT & INSTRUMENTATION

Full Marks 100

Time: ~~Two hours~~/Three hours/ ~~Four hours~~/ ~~Six hours~~   (50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART I	Marks
	Answer question:-1 and any two from the rest.	
1.	*Distinguish in brief between the following two (any four):-* a) Principle of general pressure and vacuum pressure measurement. b) Level measurement and transmission using force balance and pneumatic balance method c) Working principle of volumetric flow sensor for compressible and non-compressible fluids d) Obstruction type flow sensor and variable area type low sensor e) Between plate number and plate height in GLC	4X5=20
2.	a) Explain how liquid level control can be incorporated using spring operated diaphragm and valve. b) Discuss briefly the working principle of vacuum pressure gauge using Thermocouple. c) Distinguish between the operation of Hot cathode type and cold cathode ionization gauge for vacuum pressure measurement.	5+5+5
3.	a) Outline the basic principle of variable area type flow sensors with the help of suitable diagram. b) Write down the flow rate equation for obstruction type flow sensor using usual notations of variables and hence state the significance of expansion factor.	7+8
4.	a) Referring to the principle of mass flow type flow meter, outline briefly the working principle of reciprocating piston type flow meter	

[Turn over

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No. of Questions		Marks
5.	b) Derive the expression of flow rate for a turbine type flow meter. What is the significance of meter constant? Show the waveform of electrical signal obtained from the magnetic pick up attached to this flow meter.	7+8
	Write short notes on any three of the following: c) McLeod gauge d) Differential pressure transmitter e) Thermal ionization and flame ionization detector f) Stationery and mobile phases in chromatography g) Quantity flow meter	3X5=15

Fluid in terms of usual parameter

No. of Questions	PART I	Marks

B. E. CHEMICAL ENGINEERING EXAMINATION, 2023
3rd year, 2nd Semester, Supplementary

SUBJECT: - PRINCIPLES OF MEASUREMENT AND INSTRUMENTATION

Time: Three hours   Full Marks: 100

PART – II
Answer any THREE questions and TWO Marks are reserved for neatness.

1.a) How can you implement a cold/reference junction compensation scheme for a thermocouple, using a thermistor based bridge circuit?   8+8

  b) In the context of thermocouples, explain the "law of intermediate metals" and the "law of intermediate temperatures".

2.a) How can a pneumatic Proportional-Derivative controller be developed using Baffle-Nozzle amplifiers and bellows?   10+6

  b) Distinguish between the operation of motorized linear and rotary electric actuators.

3.a) Describe a scheme employing wheatstone bridge arrangement for measurement of resistance strain gauge output, employing half bridge configuration with two active gauges and derive an expression for its sensitivity. Show that this sensitivity becomes double for a bridge arrangement employing full bridge configuration with four active gauges.   10+6

  b) How can Callendar's four lead arrangements be used in bridge circuits employing RTD's?

4.a) How can you classify errors in measurements? What are the important objectives for applying statistics to measurement data?   8+8

  b) From the operating principle point of view, differentiate between constant current anemometer (CCA) and constant temperature anemometer (CTA). How can CTA be employed in "Manual Balance" mode for measurement of average velocity?

5. Write short notes on any TWO: 8×2=16
(i) Random errors in measurements and their statistical measures.
(ii) Total radiation pyrometer.
(iii) Temperature compensation in electrical strain gauges.