

BACHELOR OF CHEMICAL ENGINEERING 3RD YR 2ST SEMESTER EXAMINATION, 2019
2nd Semester

SUBJECT: - PRINCIPLE OF MEASUREMENT & INSTRUMENTATION

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART I	Marks
1.	<p>Answer Question: 1 and any TWO from the rest:</p> <p>Distinguish in brief between the following two (any four):-</p> <p>a) Working principles of float type and displacer type level sensor.</p> <p>b) Level measurement and transmission using force balance and pneumatic balance method.</p> <p>c) Working principle of obstruction type and variable area type flow sensors.</p> <p>d) Correction factors of obstruction type flow sensors for compressible and non-compressible liquids.</p> <p>e) Working principle of hot cathode and cold cathode type ionization gauge for vacuum pressure measurement.</p>	4X5=20
2.	<p>a) Illustrate a suitable scheme for level gauge calibration using bubbler system following hydrostatic method.</p> <p>b) Describe the working principle of level measurement using diaphragm box.</p> <p>c) Explain the working principle of potentiometric type level sensor.</p>	5+5+5
3.	<p>a) What are the disadvantages of ordinary float . Explain how this can be eliminated by magnetic float.</p> <p>b) Discuss the advantage of enlarged leg manometer and inclined manometer over U-tube manometer.</p> <p>c) Explain with the help of functional diagram, how liquid level can be measured and monitored using force balance type transmitter.</p>	5+5+5

BACHELOR OF CHEMICAL ENGINEERING 3RD YR 2ST SEMESTER EXAMINATION, 2019(1st/ 2nd Semester/Repeat/Supplementary/Annual/Bi-Annual)**SUBJECT: - PRINCIPLE OF MEASUREMENT & INSTRUMENTATION**

Full Marks 100

Time: Two hours/Three hours/ Four hours/ Six hours

(50 marks for each part)

4.	<p>a) Describe with the help of suitable diagram, the working principle of pneumatic type differential pressure transmitter. Also derive the expression between input and output quantity involved.</p> <p>b) Discuss the salient factors for designing a rotameter float under different flow conditions.</p> <p>c) A turbine type flow sensor has a bore of internal diameter of 150 mm. The rotor consists of 10 no. of blades , each of mean thickness of 5 mm , mounted on a hub of mean diameter of 30 mm . The clearance between the inlet blade tip and the bore is 2 mm and the inlet blade tip angle is 25 degree. Estimate the meter constant K in pulses /m³ and the frequency of induced AC emf in pick up coil.</p>	5+5+5
5.	<p>Write short notes on any three of the following:-</p> <p>a) McLeod gauge</p> <p>b) Ring balance manometer</p> <p>c) Pirani gauge</p> <p>d) Plate height, Number and resolution in Chromatography.</p> <p>e) Dead weight tester.</p>	3X5
		6+4+5

BACHELOR OF CHEMICAL ENGINEERING EXAMINATION, 20193rd year, 2nd Semester**SUBJECT: - PRINCIPLES OF MEASUREMENTS AND INSTRUMENTATION**

Time: Three hours

Full Marks: 100
(Each Part 50 Marks)**PART – II**Answer any **FIVE** Questions.

5×10

1. How can you classify errors in measurements? What are the important objectives for applying statistics to measurement data? 5+5
2. Prove that, in electrical resistance strain gauges, $F = 1 + 2\mu$ where, F is the gauge factor and μ is poisson's ratio. 6+4
Why do we employ pulse type excitation voltages for bridge measurements using RTDs? Describe the implementation of such a scheme in details.
3. Describe the constructional details of a platinum resistance temperature detector. Hence describe Siemen's 3-lead arrangement used for RTDs. 5+5
4. Differentiate between total radiation pyrometer and selective radiation pyrometer. Is there any difference between the terms **emittance** and **emissivity**? With a neat schematic diagram, explain in detail the operating principle of Fery's total radiation pyrometer. 4+2+4
5. How can you implement a cold/reference junction compensation scheme for a thermocouple, using a thermistor based bridge circuit? 7+3
In the context of thermocouples, explain the "law of intermediate metals".
6. Explain the advantages of parallel realization of PID control rule using electronic circuits than cascade realization. 5+5
Explain how integral windup effect can be eliminated using Clegg integrator?
7. How can a pneumatic Proportional-Derivative controller be developed using Baffle-Nozzle amplifiers and bellows? 10
8. How can you broadly classify actuators? With a neat sketch explain the operating principle of spring-diaphragm actuator with positioner. Hence derive the relation between change in output position and change in input pressure. 2+3+5