

Ref. No. : EX/ChE/EE/T/321/2018

B. E. CHEMICAL ENGINEERING 3RD YEAR 2ND SEMESTER EXAMINATION,
2018

SUBJECT: - PRINCIPLE OF MEASUREMENT & INSTRUMENTATION

TIME : 3 Hrs

Full Marks 100 (50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART I	Marks
	<p><i>Answer Q:-1 and any two.</i> (Answer any four:)</p> <p>1. (a) Discuss the different correction factors required for determination of flow rate by obstruction type flow sensor.</p> <p>(b) State the difference in working between force balance and pneumatic balance methods for level transmission.</p> <p>(c) Explain why the working principle of mass flow rate sensor does not depend on the change of density and compression effect of the fluid?</p> <p>(d) Describe in brief about the processes involved for separation of constituents in a mixture by chromatography.</p> <p>(e) Explain why electron capture detector has the best performance</p>	4 X 5=20
	<p>2. (a) Illustrate a suitable scheme for level gauge calibration using bubbler system following hydrostatic method.</p> <p>(b) Describe the working principle of level sensor using diaphragm box.</p> <p>(c) Distinguish between the working principle of float and shaft type and displace type level sensors.</p>	5+5+5=15
	<p>3.(a) Explain the working principle of positive displacement type flow sensor. Describe the working principle of any such type flow sensor with suitable diagram.</p> <p>(b) Describe the working principle of vortex shading flow sensor with diagram.</p> <p>(c) A turbine type mass flow sensor has a bore of internal diameter 100 mm. The rotor consists of 20 number of blades , each of mean thickness of 5 mm, mounted on a hub of mean diameter of 30 mm.</p>	

[Turn over

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	<p>The clearance between the inlet blade tip and the bore is 2 mm and the inlet blade angle at tip is 25 degree. Estimate the meter constant K in pulses/ m³ and the frequency of induced AC voltage.</p>	5+4+6=15
4. (a)	<p>Explain the working principle of McLeod gauge for vacuum pressure measurement with diagram.</p>	
	(b) Describe the working principle of flapper-nozzle system and explain how this element can be used in pneumatic pressure transmitter?	
	(c) What is relay amplifier? Explain how it can extend the capacity of output pressure?	5+6+4=15
5.(a)	<p>Explain why the Component having lower molecular weight will be eluted than that having higher molecular weight in gas liquid chromatography.</p>	
	(b) State important performance parameters in GLC and hence explain their significance.	
	(c) From a two component chromatogram following data are obtained as: $t_{RA}=19.92$ min, $t_{RB}=18.8$ min, $W_B=1.22$ min, $W_A=1.02$ min. The column length is 50 cm. Calculate the number of plats, plate height and resolution.	5+5+5=15

BACHELOR OF CHEMICAL ENGINEERING EXAMINATION, 20183rd year, 2nd Semester**SUBJECT: - PRINCIPLES OF MEASUREMENTS AND INSTRUMENTATION**

Time: Three hours

Full Marks: 100
(Each Part 50 Marks)**PART – II**

Answer any THREE questions. TWO marks are reserved for neatness.

1. a) Give a brief description of the following static performance parameters of instruments: 6
(i) Static Sensitivity, (ii) Resolution, and (iii) Linearity.
- b) Derive the transfer function of a general second-order instrument. Hence derive the frequency-response relation of it and sketch the frequency-response characteristics. 10
2. 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
- b) How can Callendar's four lead arrangements be used in bridge circuits employing RTD's? 6
3. a) With a neat diagram explain the constructional features of a Platinum Resistance Temperature Detector. Describe in detail the general working principle of a Resistance Temperature Detector. 10
- b) Describe in detail the experimental setups used for thermocouples with extension leads to strictly maintain the reference junction temperature at 0°C. 6
4. a) Describe the transfer function of a PID controller. How can an electronic analog PID controller be developed employing two op-amps? 8
- b) With the help of a neat diagram obtain an expression for the transfer function of a PD pneumatic controller. What is the function of a relay valve? 8
5. Write short notes on any **TWO**: 8×2
 - a) Linearization of RTDs;
 - b) Constant current type anemometer (CCA);
 - c) Total radiation pyrometer;
 - d) Random errors in measurements and their statistical measures.