Total number of printed pages:3 **Programme(D)/Semester 4 /DIE405**

2023

INSTRUMENTATION AND PROCESS CONTROL

Full Marks : 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.	a)	Explain with a neat diagram the working of Rotameter in flow measurement. Write down the equation of volumetric flow.		10
	b)	Calculate the pressure in psig that is detected by a tubular sight glass gauge if the height of the liquid is 50 inches and the specific gravity of the liquid in the tank is 1.2.		5
	c)	A force of 500 N is required to fully open a control valve that is equipped with a pneumatic diaphragm valve actuator. The valve input control signal for the actuator has a range of 20 to 100 kPa. Find the diaphragm area that is required to fully open the control valve.		5
2	a)	Explain the working of Level measurement using: -		
		i)	Ultra-sonic instrument for measuring level in a closed tank.	5
		ii)	Guided-wave radar for measurement of flour powder in a silo.	5
	b)	Explain with a neat diagram the working of pressure sensors using: -		
		i)	Bellows.	5
		ii)	Bourdon Tube.	5
3.	a)	Explain with a neat graph the inherent characteristics of: -		
		i)	Linear control valve.	5
		ii)	Equal percentage control valve.	5
	b)	Calculate the Cv for a valve that must regulate 300 gpm per minute of milk with a specific gravity of 1.05 at a pressure drop of 100 psi.		5
	c)	Calculate the pressure detected by a U-tube manometer if the liquid in the manometer has a specific gravity of 2.95 and it is displaced 20 inches when pressure is applied.		5

4	a)	Explain the following terms related to the Static characteristics of a measurement system: -		
		i)	Accuracy.	2
		ii)	Hysterisis.	2
		iii)	Sensitivity.	2
		iv)	Reproducibility.	2
		v)	Linearity.	2
		vi)	Span.	2
	b)	Define Rangeability of a Control valve.		2
	c)	Explain Gauge Pressure.		2
	d)	Explain Laminar and Turbulent flow.		4
5.	a)	Explain the construction and working of: -		
		i)	Ball Valve.	5
		ii)	pH Meter.	5
	b)	Explain the term Viscosity and how can you determine viscosity measurement in laboratory.		10
	b)	**OR** Explain the construction and working of a Chilled Mirror Hygrometer.		10
6.	a)	Explain the following terms used in a damp atmosphere wherein you have hygroscopic food material like sugar, salt in your storage area.		
		i)	Humidity.	2
		ii)	Moisture.	2
		iii)	Dew point.	2
	b)	Explain the advantages of Process Control in food processing industry		10
	c)	Explain the working of Pitot tube for measuring flow in a pipe line		4
7.	Write short notes on any FOUR from following: -			
	a)	Wheatstone bridge as a signal processing unit.		5
	b)	Flow meter device – Orifice plate.		5
	c)	Thermistor for measuring temperature.		5
	d)	ON-OFF controller for controlling flow through a solenoid valve.		5
	e)	Well type Manometer.		5

	f)	Nucleonic Level Gauge.		5
8.	Discuss the features of the following controllers and draw the response to a STEP and RAMP inputs: -			
		i)	Proportional Control.	5
		ii)	Integral control.	5
		iii)	Derivative Control.	5
		iv)	Proportional Integral and Derivative Control.	5