Reg. No.															

Question Paper Code	13428

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Seventh Semester

Electronics and Instrumentation Engineering

20ICPW701 - INSTRUMENTATION SYSTEM DESIGN WITH LABORATORY

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	Which factor most critically influences the pressure drop across an orifice plate in a flow measurement system? (a) Pipe material (b) Fluid color (c) Orifice diameter (d) Length of the pipeline	*1*	*K1*	*CO1*
2.	Which device is typically used for cold junction compensation in thermocouple circuits? (a) LVDT (b) RTD (c) Thermistor (d) Relay	*1*	*K1*	*CO1*
3.	What is the primary sensing element in a Bourdon gauge? (a) Diaphragm (b) Bellows (c) Helical spring (d) Curved tube	*1*	*K1*	*CO2*
4.	Which of the following is commonly used for purging in level measurement systems? (a) Nitrogen (b) Compressed air (c) Steam (d) Oxygen	*1*	*K1*	*CO2*
5.	Which type of pump is best suited for handling viscous fluids? (a) Centrifugal pump (b) Reciprocating pump (c) Gear pump (d) Jet pump	*1*	*K1*	*CO3*
6.	Which instrument is commonly used to measure the discharge pressure of a pump? (a) Thermocouple (b) Pressure gauge (c) Flow meter (d) Tachometer	*1*	*K1*	*CO3*
7.	Which component is essential for interfacing sensors with a microcontroller in a data acquisition system? (a) Encoder (b) ADC (Analog-to-Digital Converter) (c) DAC (Digital-to-Analog Converter) (d) Relay	*1*	*K1*	*CO4*
8.	What is the primary purpose of an annunciator circuit in industrial control systems? (a) Data storage (b) Signal amplification (c) Fault indication (d) Speed control	*1*	*K1*	*CO4*
9.	In a PID controller, the derivative term is primarily responsible for: (a) Reducing steady-state error (b) Anticipating future error (c) Increasing gain (d) Minimizing input signal	*1*	*K1*	*CO5*
10.	The proportional gain in an electronic P controller affects: (a) Only the speed of response (b) Only the stability (c) Both speed of response and steady-state error (d) Only noise reduction	*1*	*K1*	*CO5*

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11.	Infer that the orifice plate not always preferred for low-flow measurements in industrial systems.	*2*	*K2*	*CO1*
12.	Outline the role of a balancing resistor in an RTD measuring circuit.	*2*	*K2*	*CO1*
13.	Why is cold junction compensation necessary in thermocouple circuits, and how does an RTD help in it?	*2*	*K2*	*CO1*
14.	List the different forms of bourdon tube design.	*2*	*K1*	*CO2*
15.	Show that the actuator design is critical in achieving accurate valve positioning.	*2*	*K2*	*CO2*
16.	Why is the selection of valve body material important in control valve design for corrosive environments?	*2*	*K2*	*CO2*
17.	How does cavitation occur in centrifugal pumps, and how can it be minimized?	*2*	*K1*	*CO3*
18.	In what ways pipework layout affects overall pump efficiency.	*2*	*K1*	*CO3*
19.	Interlocks are used in microcontroller-based control systems. Summarize it.	*2*	*K2*	*CO4*

20.	Explain how a microcontroller processes data from multiple sensors in a DAQ system.		*2*	*K2*	*CO4*
21.	Relate how the bias adjustment important in the design of a PI controller.		*2*	*K2*	*CO5*
22.	Mention the impact of increasing the integral gain in a P+I controller.		*2*	*K1*	*CO5*

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Enumerate the suitable case studies DP transmitter parameters used for calibration.	*11*	*K2*	*CO1*
		OR			
	b)	Summarize the design parameters used for the selection of Thermocouples as a widely used temperature sensor in industries.	*11*	*K2*	*CO1*
24.	a)	Illustrate with a neat schematic diagram Direct action Pneumatic Actuator and reverse action Pneumatic Actuator. Also explain in brief safe failure operation of Spring Actuators.	*11*	*K2*	*CO2*
		OR			
	b)	Elaborate in detail valve flow characteristics with necessary diagrams.	*11*	*K2*	*CO2*
25.	a)	Demonstrate the Working Principle and operation of a) Positive displacement pump and b) Centrifugal pump.	*11*	*K2*	*CO3*
		OR			
	b)	Enumerate the pump characteristic curves, including what they represent and how to interpret the information they provide.	*11*	*K2*	*CO3*
26.	a)	Explain with interfacing diagram in detail for Microcontroller Based Data Acquisition System.	*11*	*K2*	*CO4*
		OR			
	b)	Draw and explain an Alarm Logic circuit for House Alarm Application.	*11*	*K2*	*CO4*
27.	a)	Construct a complete electronic PID controller circuit for a DC motor speed control application. Include the functional blocks, explanation of each section, and methods for tuning.	*11*	*K3*	*CO5*
		OR			
	b)	Develop an electronic P+I controller setup for a liquid level control system. Explain the circuit design, adjustment of controller parameters, and the effect of bias and set point variations.	*11*	*K3*	*CO5*
28.	a) (i)	Evaluate the design choices between using a microcontroller versus a microprocessor for implementing a real-time P+I+D controller. Discuss scenarios where one is preferred over the other.	*6*	*K2*	*CO4*
	(ii)	Compare and evaluate the effectiveness of PD and PI controllers in systems with fast dynamic changes. Highlight their advantages and limitations.	*5*	*K2*	*CO5*
		OR			
	b) (i)	Summarize the effectiveness of hardware versus software-based interlocks in safety-critical systems. Provide examples to support your reasoning.	*6*	*K2*	*CO4*
	(ii)	Show the role of tuning methods (e.g., Ziegler-Nichols) in optimizing electronic PID controller performance for temperature regulation.	*5*	*K2*	*CO5*