

Nirma University

Institute:	Institute of Technology
Name of Programme:	B. Tech. (Chemical Engineering)
Course Code:	2CH601CC23
Course Title:	Instrumentation and Process Control
Course Type:	Core
Year of introduction:	2023-2024

L	T	Practical Component			C
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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to -

1. identify the order and develop a model for linear open and closed-loop control systems (BL3)
2. determine the response and stability of the linear control system model (BL5)
3. select appropriate controllers and control valves for the control system (BL3)
4. select appropriate instruments for various applications in the chemical industry (BL3)

Syllabus:

Total Teaching Hours: 30

Unit	Syllabus	Teaching Hours
Unit I	<p>Control Systems</p> <p>Linear Open-Loop Control Systems: Physical examples of first-order systems, response of first-order systems to various inputs, first-order systems in series, higher-order systems: second-order and transportation lag.</p> <p>Linear Closed-Loop Control Systems: Control system, closed-loop transfer functions, stability, root locus, introduction to frequency response.</p> <p>Computers in Control System: Introduction to microprocessor-based controllers, distributed control system (DCS), programmable logic control (PLC), supervisory control and data acquisition (SCADA).</p>	15
Unit II	<p>Controllers and Final Control Elements</p> <p>Introduction, working, and selection of Proportional (P), Proportional Integral (PI), Proportional Derivative (PD), and PID Controllers; Introduction to types of final control elements, and introduction, working, and selection of various control valves like quick opening, linear, equal, etc.</p>	10
Unit III	<p>Industrial Instrumentation</p> <p>Introduction to elements of Measurement Instruments, Various methods for measurement of Temperature, Pressure, Level, etc.</p>	05

Self Study

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study content.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings:

1. Coughanowr, D. R. Process systems analysis and control (Indian Edition). McGraw-Hill.
2. Stephanopoulos, G. Chemical process control (An Introduction to Theory and Practice). Prentice hall India.
3. Sikdar, D.C., Instrumentation and process control, Khanna Publication
4. Eckman D, Industrial Instrumentation, CBS Publishers.
5. Kulkarni, A. P., Process Instrumentation and Control, Nirali Prakashan.
6. Radhakrishnan, V.R. Instrumentation and Control for Chemical, Mineral and Metallurgical Processes, Allied Publishers.

Suggested List of Practical (not restricted to the following) only for information

Sr. No.	Practical	Number of Hours
1	To compare dynamic characteristics (speed of response) of an instrument (thermometer).	2
2	To study resistance temperature detector (RTD) and calibrate it.	2
3	To study thermocouple and calibrate it.	2
4	To study positive & negative thermistors and calibrate them.	2
5	Liquid level measurement by air purge method	2
6	To study linear variable differential transducer (LVDT)	2
7	Response of first order (thermometer) system to step input.	2
8	Response of first order (liquid level) system to impulse input	2
9	To study response of first order (mixing process) system to step input.	2

1 0	Multi capacity (non - interacting tanks in series) system response to step input.	2
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1 1	Response of multi capacity (interacting tanks in series) system to step input.	2
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1 2	Response of second order (u-tube manometer) system to step input.	2
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1 3	To study PID control trainer as temperature control system	2
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1 4	To study PID control trainer as level control system	2
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1 5	To study inherent characteristics of control valves	2
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1 6	Virtual Lab experiments	2
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