

**SRM Institute of Science and Technology**  
Faculty of Engineering and Technology  
Department of Chemical Engineering  
Course Code & Title: **15CH308 Process Dynamics, Control and Instrumentation**  
**Course Strategy Description**

**Course description:**

This course enables the students to know about control methods and make the students knowledgeable in various types of measuring Instruments used in chemical process industries.

**Compulsory/Elective course:** Compulsory for B.Tech. Chemical Engineering

**Credit hours:** 4 credits

**Course coordinator(s):** Dr.P.Muthamilselvi, Assistant Professor (O.G.), Department of Chemical Engineering

**Instructor(s):**

Name of the instructor	Room number	Email (@ktr.srmuniv.ac.in)	Consultations (day order/periods)
Dr.K.Sofiya	PGA 205	sofiya.k@ktr.srmuniv.ac.in	Day – 1: 10
Dr. P.Muthamilselvi	PGA 205	muthamilselvi.p@ktr.srmuniv.ac.in	Day – 3: 10
Ms.R.Thilakavathi	PGA 205	thilakavathi.r@ktr.srmuniv.a.cin	Day – 4: 1 and 2

**Relationship to other courses**

Course category: Professional core

Prerequisite: 15MA202, 15CH303

Co-requisite: Nil

Following courses: Nil

**Text book(s) and/or required materials:**

- 1.Donald R. Coughanowr., Steven E. LeBlanc., "Process system Analysis & Control ", 3<sup>rd</sup> edition., McGraw Hill, New york, 2009.
2. George Stephanopoulos, "Chemical Process Control: An Introduction to Theory and Practice", Prentice Hall, New Delhi, 1984.

**Reference book(s):**

- 3.Peter Harriott, "Process Control " Tata McGraw Hill, New Delhi, 1972.
- 4.Donald P. Eckman, "Industrial Instrumentation ", Wiley Eastern Limited, 2004.
- 5.William L. Luyben , "Process modeling, simulation, and control for Chemical Engineers ", 2<sup>nd</sup> edition, McGraw Hill, New York, 1996.

**Class schedule:** D2 Slot; Four 50 minutes lecture sessions per week, for 15 – 16 weeks

<b>DAY ORDER: HOUR</b>	<b>TIMING</b>
<b>DAY - 1: 10</b>	4.10 PM – 5.00 PM
<b>DAY - 3: 10</b>	4.10 PM – 5.00 PM
<b>DAY - 4: 1 &amp; 2</b>	8.AM to 9.40 AM

### Instructional Objectives (IOs) and Student Outcomes (SOs)

S.No.	Instructional Objectives	Student Outcomes				
1	Understand the importance of process control in industrial process plants.	a				
2	Understand the use of block diagrams & the mathematical basis for the design and stability of control systems.	a	e			
3	Understand the application of good instrumentation for the effective design of process control loops for process engineering plants.	a				
4	Draw a Process & Instrumentation Diagram and devise simple but effective plant wide control strategies using appropriate methods.	a	k			
5	Design and tune process controllers and specify the required final elements to ensure that well -tuned control is achieved.	a	k			

### Teaching plan

Section	Topics	L / T	Text book/chapter	IOs	SOs	Problem solving (Y/N)
<b>Unit – I: LINEAR OPEN LOOP SYSTEMS</b>		<b>13</b>				
1	Basic Concepts of process control, Why process control, Modeling for process dynamics -mathematical tools for modeling, Laplace transform of simple functions, transforms of derivatives.	2	Text book [1] Chapter 1,2,3,4,5,6	1	a	Y
2	Solution of differential equations, inversion by partial fractions	2	Text book [1] Chapter 1,2,3,4,5,6	2	a	Y
3	Physical examples of first - order systems	3	Text book [1] Chapter 1,2,3,4,5,6	2	a	Y
4	Response of first -order systems	3	Text book [1] Chapter 1,2,3,4,5,6	2	a	Y
5	Response of first - order systems in series	1	Text book [1] Chapter 1,2,3,4,5,6	2	a	Y

6	Higher order systems: Second -order and transportation lag	2	Text book [1] Chapter 1,2,3,4,5,6	2	a	Y
<b>UNIT II: -LINEAR CLOSED LOOP SYSTEMS</b>		<b>12</b>				
7	Introduction to controllers and final control element	1	Text book [1] Chapter 8,9,10,11,12	3	a,e,k	Y
8	Principles of pneumatic and electronic controllers and mechanism of control system & block diagram	2	Text book [1] Chapter 8,9,10,11,12	3	a,e,k	Y
9	Mechanism of controllers	3	Text book [1] Chapter 8,9,10,11,12	5	a,e,k	Y
10	Mechanism of control valves	3	Text book [1] Chapter 8,9,10,11,12	5	a,e,k	Y
11	Dynamic behavior of controllers	3	Text book [1] Chapter 8,9,10,11,12	5	a,e,k	Y
<b>UNIT III: STABILITY, FREQUENCY RESPONSE ANALYSIS AND DESIGN</b>		<b>11</b>				
12	Concept of stability, definition of stability, stability criterion	1	Text book [1],[2]	1	e,k	Y
13	Stability for linear system: Routh - Hurwitz stability criterion	2	Text book [1],[2]	2	e,k	Y
14	Root locus diagram	3	Text book [1],[2]	2	e,k	Y
15	Design of control system using frequency response: Bode diagram - stability criterion, phase and gain margins	3	Text book [1],[2]	2	e,k	Y
16	Tuning of controller settings: Ziegler Nichols controller settings	2	Text book [1],[2]	2	e,k	Y
<b>UNIT IV: CONTROL SCHEMES AND MICRO PROCESSOR</b>		<b>12</b>				
17	Control systems with single loops: Feedback control systems with examples	2	Text and Reference book [2] [3] [5]	4	k	N
18	Control systems with multiple loops: cascade control, selective control systems and split -range control with examples	4	Text and Reference book [2] [3] [5]	3,4	k	N
19	Feed forward and Ratio Control with examples	2	Text and Reference book	3,4	k	N

			[2] [3] [5]			
20	Control of distillation column: control of composition and pressure	2	Text and Reference book [2] [3] [5]	3,4	k	N
21	Microprocessor - based controllers: Introduction to PLC's and DCS	2	Text and Reference book [2] [3] [5]	4	k	N
<b>UNIT V: MEASURING DEVICES</b>		<b>12</b>				
22	Principles of measurements and classification of process control instruments	2	Text book [4]	3	k	N
23	Temperature measuring instruments	2	Text book [4]	3	k	N
24	Liquid -level measuring instruments	2	Text book [4]	3	k	N
25	Pressure measuring instruments	2	Text book [4]	3	k	N
26	Composition measuring instruments	2	Text book [4]	3	k	N
27	Measurements of viscosity, pH, concentration, thermal conductivity and humidity of gases.	2	Text book [4]	3	k	N

### Evaluation methods

S.NO.	Test	Topics covered	Marks	Test/Exam duration (min)
1.	Cycle test – I	Unit I and II	15	100
2.	Cycle test – II	Unit III, IV and V	25	180
3.	Surprise test	Questions from any units	5	20
4.	Assignment	Questions from any units	5	-
5.	Final exam	All the units	50	180

### Surprise test

The surprise test will not be announced. The questions for this test will be covered until the previous class.

### Home assignments

A few units will have home assignment. All the assignments should be submitted on or before the last date of submission.

### Teaching Methodology

Chalk and talk for the entire course

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**Prepared by:** Dr. K. Sofiya, Assistant Professor (Sr.G.), Department of Chemical Engineering

**Dated:**

**Revision no.:** 1

**Date of revision:**

**Revised by:**

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Course Coordinator

Academic Coordinator

HoD/Chemical