

16CH304 PROCESS DYNAMICS AND CONTROL

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/SHS	CS	SA	S	BS
45	-	30	15	45	-	5	5	2

Course Description and Objectives:

This course deals with fundamental concepts in process control and its industrial application. The objective of this course is to provide knowledge on various control mechanisms and strategies used in chemical process industries.

Course Outcomes:

The student will be able to :

- understand the concepts of phase plane, laplace domain, and frequency domain.
- analyze nonlinear distributed and multivariable system.
- perform basic calculations for design of controllers.
- gain knowledge on advanced control strategies.

SKILLS:

- ✓ *Solve ODE using laplace transforms.*
- ✓ *Analyze dynamic behavior of physical systems.*
- ✓ *Select and design a suitable controller for a given application.*

UNIT - 1

L-9

FIRST ORDER SYSTEM : Introduction to process dynamics and control, Response of first order systems, Physical examples of first order systems, Response of first order systems in series. Higher order systems, Second order systems and transportation lag.

UNIT - 2

L-9

CONTROL SYSTEM : Controllers and final control elements, Block diagram of a chemical reactor, Control Systems, Closed loop transfer functions, Transient response of simple control systems.

UNIT - 3

L-9

STABILITY CRITERIA : Stability, Routh array, Root locus, Application of Root locus to control systems.

UNIT - 4

L-9

FREQUENCY RESPONSE ANALYSIS : Introduction to frequency response, Control systems design by frequency response, Bode diagrams.

UNIT - 5

L-9

ADVANCED CONTROL STRATEGIES : Advanced control strategies, Cascade control, Feed Forward control, Ratio control, Smith predictor, Dead time compensation, Internal mode control. Controller tuning, Process Identification, Different types of control valves and their characteristics.

ACTIVITIES:

- *Using matlab plot the root locus and Bode diagrams.*
- *Block diagram construction for a process.*
- *Effect of controller parameters on system stability.*

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS

Total hours: 30

1. Dynamics of 1st order systems [Thermometer].
2. Response of 2nd order system [Manometer].
3. Reponse of single tank system.
4. Response of interacting & non-interacting system for step input.
5. Response of interacting & non-interacting system for pulse input.
6. Control of pressure by using pressure control trainer.
7. Response of control valves.
8. Response of 1st and 2nd order system using Mat Lab.
9. Temperature control by using temperature control trainer.
10. Control of level by using level control trainer.

TEXT BOOKS:

1. Donald R Coughanowr, "Process System Analysis and Control" 3rd edition, McGraw-Hill, 2011.
2. G. Stephanopolous, "Chemical Process Control", 1st edition, Prentice Hall of India, 1998.

REFERENCE BOOK:

1. Peter Harriott, "Process Control", Tata McGraw-Hill, 2008.