

Hours Per Week :

L	T	P	C
3	-	3	4

Total Hours :

L	T	P	W/RA	SSH/HS	CS	SA	S	BS
45	-	30	25	48	-	5	5	5

Course Description and Objectives:

1. To understand and be able to describe quantitatively the dynamic behavior of process systems.
2. To learn the fundamental principles of control theory including different types of controllers and control strategies.
3. To estimate the stability limits for a system, with or without control.

Course Outcomes:

The student will be able to :

1. Describe a process, how it works and what the control objectives are.
2. Describe processes with appropriate block diagrams.
3. Numerically model a process.
4. Identify the stability limits of a system.

SKILLS:

- ✓ Apply the advance control strategies.
- ✓ Tune process controllers.
- ✓ To describe quantitatively the behavior of simple control systems and to design control systems.
- ✓ To get exposure to advanced control strategies.
- ✓ To design and tune a control loop and to apply this knowledge in the industry/laboratory.

ACTIVITIES:

- To design different types of control valves.
- Design and operate control valves.

UNIT - 1**L-9**

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 and transportation lag.

UNIT - 2**L-10**

Control systems controllers and final control elements, Block diagram of a Petrochemical reactor control system. Closed loop transfer functions, Transient response of simple control systems.

UNIT - 3**L-9**

Stability Criterion, Routh Test, Root locus, Transient response from root locus, Application of root locus to control systems Introduction to frequency response, Control systems design by frequency response.

UNIT - 4**L-9**

Advanced control strategies, Cascade control, Feed forward control, Ratio control, Smith predictor, Dead time compensation, Internal model control.

UNIT - 5**L-9**

Controller tuning and process identification, Control valves.

List of Experiments:

1. Calibration and determination of time lag of various first and second order instruments. Major equipment - First order instrument like Mercury-in-Glass thermometer and overall second order instrument like Mercury-in-Glass thermometer in a thermal well.
2. Experiments with single and two capacity systems with and without interaction.
Major equipment- Single tank system, Two-tank systems (Interacting and Non-Interacting).
3. Level control trainer
Major equipment - Level control trainer set up with computer.
4. Temperature control trainer
Major equipment -Temperature control trainer with computer.
5. Cascade control
Major equipment -Cascade control apparatus with computer.
6. Experiments on proportional, reset, rate mode of control etc. Major equipment – PID control apparatus
7. Control valve characteristics
Major equipment – Control valve set up.
8. Estimation of damping coefficient for U-tube manometer Major equipment - U-tube manometer.