

PSE-823 Advanced Process Dynamics and Control

Credit Hours: 3

Pre-requisites: Nil

Course Objectives:

- To provide an in-depth understanding of process control, with emphasis on the automatic control, which is an essential technology to maintain the safe, economical and environmentally benign operation of manufacturing processes.
- To specifically impasses on realizing the need and challenges for efficient control of complex and highly integrated processes in modern industrial plants.

Course Contents:

- **Modeling for Process Dynamics:**
Modeling Tools for Process Dynamics, Inversion by Partial Fractions
- **Linear Open-Loop Systems and Closed-Loop Systems:**
Second Order and Transportation Lag, The Control System, Controllers and Final Control Elements, Block Diagram of a Chemical-Reactor Control System, Proportional Control of System with Measurement Lag, Stability
- **Frequency Response:**
Control System Design by Frequency Response
- **State-Space Methods:**
State-Space Representation of Physical Systems, Transfer Function Multivariable Control
- **Nonlinear Control:**
Case-studies of Nonlinear Systems, Case-studies of Phase-Plane Analysis
- **Process Applications:**
Advanced Control Strategies, Controller Tuning and Process Identification, Theoretical Analysis of Complex Processes
- **Computers in Process Control:**
Microprocessor-Based Controllers and Distributed Control, Distributed Control

Course Outcomes:

- This course will fill the gap between basic control configurations (Practical Process Control) and model predictive control (MPC).
- In addition, the economic aspects of the application of the various advanced control technologies are stressed throughout this course.

Recommended Reading (including Textbooks and Reference books)

- Smith, Cecil L. Advanced Process Control: Beyond Single Loop Control. John Wiley & Sons, 2011.
- LeBlanc, Steven E., and Donald R. Coughanowr. "Process systems analysis and control." (No Title) (2009).
- Roffel, Brian, and Ben H. Betlem. Advanced practical process control. Berlin, Germany: Springer, 2004.