Addis Ababa University
Addis Ababa Institute of Technology
School of Chemical and Bio Engineering

Course Name: Process Dynamics and Control (CBEg3162)
Academic Year: 2019/2020 (2012 E.C) Semester II ECTS: 7

Course Objective:

- To gain practical and theoretical knowledge related to modeling, simulation and analysis of chemical process; designing, analysis and tuning of feedback and feed forward control systems for single input-single output processes.

Learning Outcomes:
At the end of the course, the students should be able to:

- Explain design steps of control system
- Develop mathematical model and analyze degree of freedom for common chemical processes
- Analyze the dynamic and static behavior of chemical processes with and without controllers
- Analyze stability of controlled processes with feedback controller
- Design PID controller, Tuning and Troubleshooting for feedback control system
- Design Feed forward Controller Based on Steady and Dynamic State Models.

Course Contents:

1) Introductory Concepts
   1.1. Introduction to Process Control
   1.2. The Influence of Process Design on Process Control
   1.3. Selection of Controlled, Manipulated, and Measured Variables
   1.4. Process Safety and Process Control
   1.5. Transmission Lines
2) Theoretical Models of Chemical Processes
   2.1. The Rationale for Dynamic Process Models
   2.2. General Modeling Principles
   2.3. Degrees of Freedom Analysis
   2.4. Dynamic Models of Representative Processes
3) Dynamics Behavior of Process
   3.1. Laplace Transforms (LT)

3.2. Solution of Differential Equations by LT Techniques

3.3. Transfer Function and State-Space Models

4) Dynamic Behavior of First and Second Order Processes

4.1. Standard Process Inputs

4.2. Response of First-Order Processes

4.3. Response of Integrating Processes

4.4. Response of Second-Order Processes

5) Feedback and Feed forward Control

5.1. Feedback Controllers

5.2. Dynamic Behavior and Stability of Closed-Loop Control Systems

5.3. Stability of Closed-Loop Control Systems

5.4. PID Controller Design

Assessment/Evaluation System:
Assignment = 10; Qiuz = 5; Test = 25; Lab = 10 Final = 50
Attendance Requirements:
At least 85 percent of lectures and 100 percent of Laboratory

Reference books

1) Seaborg, Process Dynamics and Control (2nd edition), 2004 John Wiley and Sons, Inc (Text)

2) Stephanopoulos, G., Chemical Process Control, An Introduction to Theory and Practice, 2002

3) Luyben, W.L., Process Modeling, Simulation, and Control for Chemical Engineering, 1974

4) B. Wayne Baguette, Process Control, Modeling, Design and Simulation, 2003