COURSE #: CHE 466 (3 credits)

COURSE TITLE: Process Dynamics and Control

TERMS OFFERED: Fall

PREREQUISITES: CHE 343: Separation Processes, CHE 344: Reaction Engineering and Design

TEXTBOOKS/REQUIRED MATERIAL: Process Dynamics and Control, 4th edition, D. Seborg, D. Mellichamp, T. Edgar, F. Doyle (Wiley, 2016) ISBN: 978-1-119-28595-3

COGNIZANT FACULTY: Allman, Lin, Ziff, Singh

INSTRUCTORS: Allman, Lin, Ziff

FACULTY APPROVAL: 2019-11-05

CoE BULLETIN DESCRIPTION:

Introduction to process control in chemical engineering. Control architecture design, notation, and implementation. Mathematical modeling and analysis of open-loop and closed-loop process dynamics. Applications to the control of level, flow, heat exchangers, reactors, and elementary multivariable systems. Statistical process control concepts.

COURSE TOPICS: (approximate number of hours in parentheses)

1. P&ID (Piping and Instrumentation Diagrams), sensors and valves (8)
2. Analysis of unsteady-state models of unit operations (12)
3. Tuning of PID (Proportional-Integral-Derivative) controllers (4)
4. Feed-forward, Cascade, Ratio, and advanced control strategies (10)
5. Optimization, statistical process control (4)

COURSE STRUCTURE/SCHEDULE: Lecture: 2 per week @ 1.5 hours

COURSE OBJECTIVES

Links shown in brackets are to course outcomes that satisfy these objectives.

1. Provide a conceptual and methodological framework for describing a process and its control system. [a-f]
2. Provide a conceptual and methodological framework for quantitatively analyzing and evaluating automatic control systems for chemical processes [c-g]

COURSE OUTCOMES

Links shown in brackets are to ABET student outcomes 1-7.

a. Draw piping and instrumentation diagrams following accepted standards and using appropriate symbols [1,2].
b. Explain the operation of sensors and valves, including appropriate placement and linking [2].
c. Formulate unsteady state models for common unit operations, and solve the resulting differential equations using analytical and numerical methods [1].
d. Explain the operation of P, I, D, and PID controllers, and be able to simulate them and tune them using classical methods [1]
e. Explain and implement feedback, feed forward, ratio, and cascade control architectures [1].
f. Apply control strategies to address safety and environmental issues [2,4].
g. Apply optimization to address design and economic considerations [2].

ASSESSMENT TOOLS

1. Homework and class problems assess outcomes a-g
2. Exams assess outcomes a-g
3. End-of-term course evaluation provides student self-assessment of outcomes a-g