

Department of Chemical Engineering  
Lamar University

**CHEN 4331 – Process Control I**  
Fall 2017 Semester

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- CATALOG DATA:** CHEN 4331. Process Control. Credit 3. Required. Control loop hardware; characteristics of control elements; system dynamic analysis; process control systems.
- PREREQUISITES:**
1. Reaction Kinetics (CHEN 4410)
  2. Mass Transfer (CHEN 4420)
  3. Ordinary Differential Equation (MATH 3301)
- TEXTBOOK:** "Chemical and Bio-Process Control" (4th Edition), by J. B. Riggs and M. N. Karim, Ferret Publishing, 2016 (ISBN 0-9669601-8-1)
- REFERENCE:** Control Station Hands-on Workshop Series and Manuscript
- COORDINATOR:** Qiang Xu, Professor of Chemical Engineering Dept.  
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Tianxing Cai, Visiting Assistant Professor of Chemical Engineering Dept.  
Office hours: 10:00-11:00 am Mon.; Rm: Lucas 103  
Tel: (409) 880-7006; E-mail: tc@lamar.edu
- COURSE OBJECTIVES:** The main goal of this course is to provide students with the fundamental theories and knowledge of process control systems and necessary skills required for a chemical process engineer.
- COURSE SCHEDULE:** MW12:30 - 1:50 pm, Maes 106
- TOPICS:**
1. Introduction to process control, instrumentation symbols and labels.
  2. Control loop hardware.
  3. Process dynamic modeling, mass & energy balances.
  4. Laplace transform and transfer functions.
  5. Dynamic behavior of ideal systems.
  6. Fundamentals of PID control system.
  7. PID controller tuning.
  8. Troubleshooting control loops.
  9. Dynamic simulation and control.
  10. Cascade, ratio and feed forward Control (Tentative).
- COMPUTER SOFTWARE USAGE:**  
Extensive usage of Spreadsheet and/or Polymath for homework.  
Proficient at Control Station for PID control loop analysis, tuning, and troubleshooting.  
Know about Aspen Plus Dynamics.

Matlab usage for solving the homework problems will be encouraged.

**ASSESSMENT:**

1. Homework (assigned regularly after every chapter is completed)	10%
2. Attendance	5%
3. Exams (middle 30%; final 45%)	75%
4. Project (PID analysis and tuning)	10%

**MEASURED OUTCOMES:** (Numbers in brackets indicated assessment methods. Letters in parentheses indicate ABET Criteria outcomes supported by these assessments.)

- Objective 1: Demonstrate the ability to apply knowledge of math, science and engineering to formulate mathematical descriptions of control loops, and to develop system model equations according to various constraints. [1, 2, 3] (a, c, e)
- Objective 2: Demonstrate the ability to design and conduct control-loop numerical experiments, as well as to analyze the dynamic response results. [1, 4] (b, k)
- Objective 3: Demonstrate the ability to design a simplified PID and testing of control loops to meet the desired needs. Demonstrate the ability to use modern engineering tools for control loop analysis, tuning, and troubleshooting. [1, 2, 4] (a, b, c, e, k)
- Objective 4: Demonstrate the ability to select control valves, transmitters, and sensors for a specific application. [1, 3] (c, k)
- Objective 5: Students have knowledge of contemporary control technologies, and have a recognition of the need for life-long learning. [1] (i, j)

**DISABILITIES:**

Individuals who have any disability, either permanent or temporary, which might affect their ability to perform in this class are encouraged to inform the instructor timely. Adaptation of methods, materials, or testing may be made as required to provide for equitable participation.

**PROFESSIONAL PROGRAM:**

ABET Category content as estimated by faculty member who prepared this course description:  
Engineering Science – 2 credits. Engineering Design 1 credit.

**Emergency Procedures:**

Many types of emergencies can occur on campus; instructions for severe weather or violence/active shooter, fire, or chemical release can be found at:

<http://www.lamar.edu/about-lu/administration/risk-management/index.html>.

Following are procedures for the first two:

**Severe Weather:**

- Follow the directions of the instructor or emergency personnel.
- Seek shelter in an interior room or hallway on the lowest floor, putting as many walls as possible between you and the outside.
- If you are in a multi-story building, and you cannot get to the lowest floor, pick a hallway in the center of the building.

- Stay in the center of the room, away from exterior walls, windows, and doors.

**Violence/Active Shooter (CADD):**

- **CALL** - 8-3-1-1 from a campus phone (880-8311 from a cell phone). Note: Calling 9-1-1 from either a campus phone or cell phone will contact Beaumont City Police Dispatch rather than University Police.
- **AVOID** - If possible, self-evacuate to a safe area outside the building. Follow directions of police officers.
- **DENY**- Barricade the door with desks, chairs, bookcases or any other items. Move to a place inside the room where you are not visible. Turn off the lights and remain quiet. Remain there until told by police it is safe.
- **DEFEND** - Use chairs, desks, cell phones or whatever is immediately available to distract and/or defend yourself and others from attack.

**Academic Continuation Policy:**

In the event of a campus closure due to hurricane or other disaster courses will continue after a four day lapse to allow time for evacuation. This course will be conducted via email. Students must begin checking their Lamar email address for where instructions and course materials and required student work will be sent and received by the instructor.

**NOTES:**

1. All exams will be open lecture notes and open homework solutions (solved by the student himself/herself). The only electronic device that will be allowed for exams are calculators that do not have the capability to communicate with other devices. The grades of exams will be based on the detailed steps of solutions, not just answers. Anyone giving or receiving unauthorized information during an examination will be given failing grade for the exam.
2. There will be no make-up exams except some very special cases (doctor and department chair's proofs should be provided).
3. Late homework will not be graded. Students should attend all classes, exams, and complete project to pass the course, and are responsible for the material covered in the classes that they miss.
4. In the class, the behaviors of browsing internet not related to the class content are not acceptable.

**Prepared by:** Drs. Qiang Xu and Tianxing Cai, August 23, 2017.