

Fall 2018

# CHE 489 - Process Dynamics and Control

Ezinwa Elele

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**COURSE OUTLINE**  
**ChE 489: Process Dynamics and Control**  
**Fall 2018**

- Instructor:** Dr. Ezinwa Elele
- Office:** Tiernan 387
- Phone:** (973) 596-5729
- E-mail address:** [eo4@njit.edu](mailto:eo4@njit.edu)
- Time & Place of Class:** Friday, 09:15 AM - 11:20 AM, KUPF 106  
Tuesday, 10:00 AM - 12:05 PM, KUPF 209
- Office hours:** Tuesday, 1:00 p.m.– 2:00 p.m. or individual appointment, Tier 387
- Course Prerequisites:** ChE 349; ChE 365
- Course Description:** This course is an introduction to chemical process dynamics and control. Topics include analysis of the dynamics of open-loop systems, the design of control systems, and the dynamics of closed-loop systems. Control techniques and methodologies, used by practicing chemical engineers, are emphasized.
- Textbook:** Process Dynamics and Control (4th Edition) by Seborg, Edgar, Mellichamp and Doyle, John Wiley & Sons, Inc.  
ISBN: 978-1-119-28591-5

**Course Objectives:**

- Students will be able to model chemical engineering processes and analyze/predict their dynamics both for open- (without control) and closed-loop (with control) cases.
- Students will be able to develop control strategies and select the most appropriate input to manipulate, and to tune controllers to meet/achieve specified process objectives.
- Students will be able to work effectively in problem-solving teams and assess the performance of their teammates and themselves on the group efforts.

**Grading schemes:**

<b>Category</b>	<b>Score</b>
In-class group activities	8%
Homework and Quizzes	12%
Project	15%
Exam 1	20%
Exam 2	20%
Final Exam	25%

**Grade:**

A final course grade will be assigned on the following basis:

<b>Weighted final score (%)</b>	<b>Letter Grade</b>
90-100	A
85-89.9	B+
80-84.9	B
75-79.9	C+
70-74.9	C
60-69.9	D
<60	F

**In-class group activities:**

You will be assigned to work in teams and complete many in-class activities with your team. The performance of your team is part of your course grade.

**Homework and Quizzes:**

- Homework assignments will be uploaded on Moodle. Typically, it will mirror and extend the problems treated in the classroom to test understanding of concepts
- Please write legibly and organize your homework so that it will be easy to understand and grade. You can also type your work.
- A late homework will not be accepted and no extension will be granted unless there is a legitimate excuse. A homework is considered late if received later after the deadline.
- Quizzes will be given in class throughout the semester. Students who do their assigned homework assigned and actively participate in in-class activities will have no problems passing the quizzes.

**Exam:**

Exams will test materials treated in class and questions will range in difficulty from easy to challenging. The exams will be cumulative and will be taken during a class period. There will be no make-up exam for students who miss an exam unless there is a legitimate excuse.

**Project:**

Project will be posted in Moodle and will be discussed in class. Part of the project will require knowledge of an engineering software such as MATLAB.

**Courtesy Reminders:**

- Attendance is important. There is a high correlation between failure and poor class attendance
- There will be no eating, drinking, use of cell phone, cameras or laptops in the class unless you are permitted by the instructor.
- All class assignments are expected to be submitted timely.
- In this course, each voice in the classroom has something of value to contribute. You are expected to behave professionally and show respect to fellow students and the instructor. Exhibit a conduct that is attributable to a professional engineer.

**Academic Integrity:**

The NJIT Honor Code and standards of *academic integrity* will be enforced in this course. Any violation will be brought to the immediate attention of the Dean of Students. All students are encouraged to look over the University Code on Academic Integrity and understand this document.

Students are expected to uphold the integrity of this institution by reporting any violation of academic integrity to the Office of the Dean of Students.

**Student with disabilities:**

NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact Student Disability Services. Information on the self-identification, documentation and accommodation process can be found on the webpage at: <http://www.njit.edu/counseling/services/disabilities.php>.

**Schedule**

<b>Week</b>	<b>Date</b>	<b>Topics</b>	<b>Chapter/Section</b>
Week 1	Tues: 09/04 Fri: 09/07	Introduction to process dynamics and control	1.1, 1.2 , 1.3, 1.4, 1.5 and 1.6
Week 2	Tues: 09/11 Fri: 09/14	Theoretical models of chemical processes	2.1, 2.2, 2.3, 2.4 and 2.5
Week 3	Tues: 09/18 Fri: 09/21	Laplace transforms	3.1, 3.2, 3.3, 3.4 and 3.5
Week 4	Tues: 09/25 Fri: 09/28	Transfer function models	4.1, 4.2 and 4.3
Week 5	Tues: 10/02 Fri: 10/05	Transfer function models (cont.) <b>Exam 1</b>	4.1, 4.2 and 4.3
Week 6	Tues: 10/09 Fri: 10/12	Dynamic behaviors of first order processes	5.1, 5.2 and 5.3
Week 7	Tues: 10/16 Fri: 10/19	Dynamic behaviors of second order processes	5.4
Week 8	Tues: 10/23 Fri: 10/26	Dynamic response characteristics of more complicated processes	6.1, 6.2, 6.3, 6.4, 6.5 and 6.6
Week 9	Tues: 10/30 Fri: 11/02	Feedback controllers and control system instrumentation <b>Exam 2</b>	8 and 9
Week 10	Tues: 11/06 Fri: 11/09	Feedback controllers and control system instrumentation Dynamic behavior of closed-loop systems <i>(Project assigned)</i>	8 and 9 11.1, 11.2, 11.3
Week 11	Tues: 11/13 Fri: 11/16	Dynamic behavior of closed-loop systems	11.1, 11.2, 11.3
Week 12	Tues: 11/20 Fri: 11/23	Stability of closed-loop control <b>Thanksgiving Recess</b>	11.4, 11.5
Week 13	Tues: 11/27 Fri: 11/30	Stability of closed-loop control PID controller design and tuning <i>(Project due)</i>	11.4, 11.5 12.1, 12.2, 12.3
Week 14	Mon: 12/04 Wed: 12/07	PID controller design and tuning	12.1, 12.2, 12.3
Week 15	Mon: 12/11	Feedforward and ratio control	15
		<b>Final Exam: TBA</b>	