Chemical and Materials Engineering Syllabi

NJIT Syllabi

Spring 2019

CHE 489-002: Process Dynamics and Control

Nellone Reid

Recommended Citation

Reid, Nellone, "CHE 489-002: Process Dynamics and Control" (2019). *Chemical and Materials Engineering Syllabi*. 53.
https://digitalcommons.njit.edu/cme-syllabi/53

ChE 489: Process Dynamics and Control

Spring 2019

Instructor: Dr. Nellone Reid, Senior University Lecturer
Office/Lab: 364 Tiernan Hall, Phone: 973-596-2995, E-mail: nellone.e.reid@njit.edu
TA: Qian Lei, E-mail: ql74@njit.edu
Class: Monday, 10:00 AM – 12:05 PM, Kupfrian Hall 210
        Wednesday, 11:30 AM – 1:35 PM, Weston Lecture Hall 2
Office Hours: Tuesday, Thursday, 1:00 PM - 3:00 PM

Course Description and Requirements

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.

Pre-Requisites: ChE 349; ChE 365

Course Objectives

Taking this course, a motivated student will learn to:
- 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.

Learning Materials

Textbook Required: Process Dynamics and Control (4th Edition) by Seborg, Edgar, Mellichamp and Doyle, John Wiley & Sons, Inc. ISBN: 978-1-119-28591-5

Other Learning Material: Reading lecture notes will be necessary but not sufficient for preparation for quizzes and exams. Therefore reading the textbook before each class will be necessary.

Calculator: A high-end calculator (TI-83, TI-84 or TI-84SE) is required for solving exam problems.

Software: Use of Matlab, Python or other computational software is strongly recommended for working on homework assignments.

Course Outline

Week	Date	Topic	Chapter/Section	Assessment
1	Jan. 22, 24	Introduction to process dynamics and control	1.1, 1.2 , 1.3, 1.4, 1.5 and 1.6	Homework
2	Jan. 29, 31	Theoretical models of chemical processes	2.1, 2.2, 2.3, 2.4 and 2.5	Quiz
3	Feb. 5, 7	Laplace transforms	3.1, 3.2, 3.3, 3.4 and 3.5	Homework
4	Feb. 12, 14	Transfer function models	4.1, 4.2 and 4.3	Quiz
5	Feb. 19, 21	Transfer function models (cont.)	4.1, 4.2 and 4.3	**Exam 1**
6	Feb. 26, 28	Dynamic behaviors of first order processes	5.1, 5.2 and 5.3	Homework
7	Mar. 5, 7	Dynamic behaviors of second order processes	5.4	Quiz
8	Mar. 12, 14	Dynamic response characteristics of more complicated processes	6.1, 6.2, 6.3, 6.4, 6.5 and 6.6	Homework
9	Mar. 19, 21	Spring Break	Spring Break	Spring Break
10	Mar. 26, 28	Feedback controllers and control system instrumentation	8 and 9	**Exam 2**
11	Apr. 2, 4	Dynamic behavior of closed-loop systems *(Project assigned)*	11.1, 11.2, 11.3	Homework
12	Apr. 9,11	Stability of closed-loop control	11.4, 11.5	Quiz
13	Apr. 16, 18	Stability of closed-loop control PID controller design and tuning *(Project due)*	11.4, 11.5 12.1, 12.2, 12.3	Homework
14	Apr. 23, 25	PID controller design and tuning	12.1, 12.2, 12.3	**Exam 3**
15	Apr. 30, May 2	Feedforward and ratio control	15	
				Final

Assessment and Grading

Homework/Quizzes/In-Class Activities	20%
Project	15%
Exams	40%
Final Exam	25%
	100%

Policies

NJIT Honor Code: The NJIT Honor Code will be upheld and any violations will be brought to the immediate attention of the Dean of Students.

Special Needs: If you need accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services, Fenster Hall Room 260 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

Lectures

- Attendance is strongly recommended. Attendance sheet has to be signed at the beginning of each class. The examples discussed in the class are not necessarily from the main textbook and therefore missing a class will have consequences for preparation to quizzes and exams.
- Electronic devices other than calculators (laptops, tablets, cell-phones etc.) are not permitted during the classes. No audio or video recording is allowed.
- Cellphones should be turned off during both lectures and exams and not allowed under any circumstances.
- Laptops will be permitted only if necessary for class activities.
- No eating any time during the classes.

Course materials, office hours and correspondence

- The course Moodle page is the main platform for delivering information about the course. All relevant course materials and assignments will be posted on Moodle, so a student should check it regularly.
- The students should upload a professional-looking head shot for their Moodle profile.
- The students are strongly encouraged to attend Office Hours held bi-weekly. Long questions, which require derivations will be discussed only during the Office Hours and will not be answered by email.
- Questions regarding grades can be discussed only during the Office Hours.
- E-mail and Moodle correspondence is intended only for quick questions. Questions which require a detailed discussion should be discussed in person during the Office Hours.
- To assure quick response to your emails, please add "ChE489" in the subject of your emails.
- The instructor reserves the right not to respond to emails if the email does not have a greeting or a signature.

Exams and Grades

- A letter grade is based on the final score, calculated using an Excel spreadsheet in accordance with the Tables given in this syllabus. The assigned letter grade is final and cannot be negotiated.
- A student can dispute the exam scores within a week after the announcement of the score. Exam scores can be disputed during the official Office Hours, not during class time or via email.
- The graded exams must be returned within a week to be saved for the department course assessment initiative.
- Students will get 0 for not showing to quizzes, exams, or any other course activity. If students miss an exam due to extreme circumstances (such as a medical problem), they need to notify the instructor via email before the beginning of the exam, and bring proof of the circumstance to the Dean of Student's office. Only in this case of official approval from the Dean of Student's office, may a makeup be given at the discretion of the instructor.
- A student must show as many details when solving a problem during an exam or a quiz. Not showing the work will cause losing points even if the final answer is correct.
- Partial credits can be given for solving the exams problems.
- No partial credit will be given if there is not enough details to follow.
- The final answer should be always evaluated with respect to its reasonability. No partial credit will be given if the final answer is wrong and unreasonable, and it is not stated.
- There will be no partial credits for the questions/problems quizzes.
- Student handwriting must be legible in order to receive points.
- A student coming to dispute a grade has to bring completed homework sheets. No discussion of grades will be held without completed homework.