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Uttyler.edu/engineering

MENG 5330 – Process Control
Course Syllabus

Semester / Year	Fall 2024
Catalog Description	The course focuses on the use of controls in the process industry. The development of process models will involve measurement of variables, controller types, and final elements. Design and evaluation of controllers in processes including thermal systems will be carried out. General instrumentation design and practice will be conducted. Graduate students are expected to carry out a major project as an assignment within this course.
Prerequisites	MENG 4312 or EENG 4308 (or Equivalent Controls course)
Section Number	MENG 5330.050, MENG 5330.051
Instructor Name	Dr. M. A. Rafe Biswas
Contact Information	Email: mbiswas@uttyler.edu , Zoom ID & Phone: 903 566 6115 , Office: HEC A214
Class Type / Instruction Mode / Location	Face-to-Face Lecture HEC A216/ Zoom Lecture RBN 3039
Class Time	T 5:00PM - 7:45PM
Office Hours	TWTh 11:10 am to 12:20 pm, or By appointment
No. of Credits	3
Required Textbook	None
Optional References	Recommended textbooks (some available via library using patriots account) – - Chapter 8 Process control from Green, Don W., and Robert H. Perry. "Perry's chemical engineers' handbook." 8th Ed., McGraw-Hill Education (2007). - Chandra, Rames Panda, and T. Thyagarajan. Introduction to Process Modelling Identification and Control for Engineers, An, Alpha Science International, 2017. ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/uttyler/detail.action?docID=5426842 - Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, and Francis J. Doyle, Process Dynamics and Control, 3rd Ed., John Wiley and Sons, New York (2010). - Advanced Process Engineering Control by Paul Serban Agachi, , Mircea Vasile Cristea, , Alexandra Ana Csavdari, , and Botond Szilagyi, https://ebookcentral-proquest-com.ezproxy.uttyler.edu/lib/uttyler/reader.action?docID=4793896&ppg=1 - Fundamentals of Automatic Process Control by Uttam Ray Chaudhuri , and Utpal Ray Chaudhuri, https://ebookcentral-proquest-com.ezproxy.uttyler.edu/lib/uttyler/reader.action?docID=1446970&ppg=1 Additional Material on Canvas: Websites, Class Handouts, Tutorials on MATLAB and Simulink by Mathworks, Inc.

Additional Rules and Requirements	MATLAB, Simulink & Simscape by MathWorks, Inc. (available through virtual desktop – one.uttyler.edu and IT support) I encourage you to explore using artificial intelligence (AI) tools, such as Copilot and ChatGPT, for all assignments and assessments. Any such use must be appropriately acknowledged and cited, following the guidelines established by the IEEE Style Guide, including the specific version of the tool used. The submitted work should include the exact prompt you used to generate the content and the AI's complete response as an appendix. Because AI-generate content is not necessarily accurate or appropriate, you must assess the validity and applicability of any submitted AI output. You will not earn full credit if inaccurate, invalid, or inappropriate information is found in your work. http://journals.ieeeauthorcenter.ieee.org/wp-content/uploads/sites/7/IEEE_Reference_Guide.pdf The use of cellular phones during the lectures is prohibited. If a student uses the cellular phone (call, text, internet), he/she will be asked to leave the classroom and penalties of missing the class will apply. It is highly recommended to keep your cellular phone off.
Evaluation Method	**Project 50%** **Exam, Assignments, & Class Participation and Conduct 50%**
Grading Policy / Scale	Letter grades, scale: A: 90 – 100; B: 80 – 89; C: 70 – 79; D: 60 – 69; F: < 60
Important Events / Dates	Census date: September 9 Last date to withdraw from one or more 15-week courses: November 4 Final Project Report: Finals week (week of December 9)
Attendance / Makeup policy / other rules	Attendance is expected per university policy. Attendance of lectures may be regularly checked using Canvas. Make-up exams or assignments if approved will be administered during finals week. No email submission of assignment(s). All assignments MUST be submitted to Canvas for grading. Student with SAR status should contact the UT Tyler Office of Student Accessibility and Resources for exam arrangements. Any minor violation of the Student Behavior by a student will result in a full letter grade reduction for each incident and any single major violation such as cheating and plagiarism by a student will result in automatic failing grading in the course. Late submissions of assignments, lab reports (e.g., if due at 11:59:00 pm, then any time after such as 11:59:30 pm is late) will result in 10 % deduction per day from the graded score until down to 10% remaining. Late or no submission for any exam results in automatic grade of zero. Questions involving knowledge covered in class will be answered if the student proves that they have tried to come up with the answer. Solution to homework and quizzes will not be given. However, students can work on the right solution by checking their work with the instructor.

	Grade appeal: grades can be appealed by sending a Canvas message in written or typed format and then meeting the instructor during office hours, but no later than a week after the grade has been posted. Moreover, students may appeal any grade reduction to the instructor if valid excuse with documentation is provided. Note: your final semester grade is based on the 10-point scale. No curving or scaling will be applied even if you receive borderline grade such as 79.99.
Course Learning Objectives / ABET & PEOs Relation	By the end of this course, students will be able to: 1. Ability to develop mathematical models and transfer functions of processes. 2. Analyze and model dynamic processes in time domain. 3. Utilize computational tools to design and analyze different types of control systems. 4. Able to read and interpret block diagrams, and process and instrumentation diagrams. 5. Relate the use of control systems to real-world problems.
Tentative Topics / Course Plans	• Mathematical modeling of different processes includes thermal fluid systems • Transfer Function and State-Space models • Characteristic Dynamic Behavior and Analysis of Processes including empirical modeling like machine learning • Advanced Control architectures including Feedback and Feedforward control • Control System Design, Tuning and Analysis • Process and instrumentation diagram • Machine Learning • Self-directed project investigation.
University Policies	https://www.uttyler.edu/offices/academic-affairs/files/syllabus-information.pdf

Tentative Course Schedule

Week of		Chapter /Class Activity	Major Assignments due
Aug	26	Intro to Process Control/Review Syllabus, Laplace Transform & Transfer Functions	Welcome and Intro
Sep	2	Dynamic modeling of thermal fluid energy systems	
	9	Work on Project	Exam 1
	16	FODT/SODT/Higher order system characteristics	Scope Report
	23	Empirical Modeling/System Identification	
	30	Empirical Modeling/Machine Learning/Work on Project	
Oct	7	Empirical Modeling/Control System Instrumentation	
	14	Feedback Control/Work on Project	
	21	PID Controller Design and Tuning	Progress Report
	28	Feedforward Control	
Nov	4	Enhanced/Combined Control Strategies	
	11	Enhanced/Combined Control Strategies	
	18	Work on Project	Exam 2
	25	Thanksgiving Week - No Classes	
Dec	2	Work on Project	
	9	Finals week (No classes)	Final Project Report Due

Evaluation activities

- Exam: There will be 2 Exams during the semester. Exam 1 is a review assignment that covers Differential Equations including Laplace Transform concepts. Exam 2 is comprehensive and related to the project. No late submission will be accepted and will result in automatic grade of zero. Make-up exam if approved by instructor will be administered during finals week.
- Project: There will be 3 recorded slide presentations during the semester. Each student will choose a complex thermal fluid energy system to model and control which they will present as Scope Report. Each student analyzes the system and simulate the system using MATLAB and Simulink® to then submit Midterm/Progress Report. Each student then develops the control architecture for given system and provide results for different operating (input/disturbance) conditions to then submit Final Report. *Each student has option to collaborate and present with a maximum of 2 students – completely optional and no peer evaluation will be considered*. Instructions on the report format/style, grading rubric form and checklist will be posted separately. No late submission will be accepted and will result in automatic grade of zero. Late submissions of assignments will result in 10% deduction from the graded score after each 24-hour period.
- Assignments, Class Participation and Conduct: Attendance and participation to lectures are expected per university policy. Check class and Canvas regularly for any announced assignments according to the topics covered in lectures. Questions involving knowledge covered in class can be checked if your work is shown to the instructor, but no solutions will be posted on Canvas. Come prepared to class by reviewing relevant material, taking notes, solving problems and participating in discussions, which are all expected. Late submissions of assignments will result in 10% deduction from the graded score after each 24-hour period.

Instructions on the oral/video report format/style, checklist and grading rubric form will be posted separately on Canvas. Figure 1 shows approximate amount time that should be invested into the course weekly.

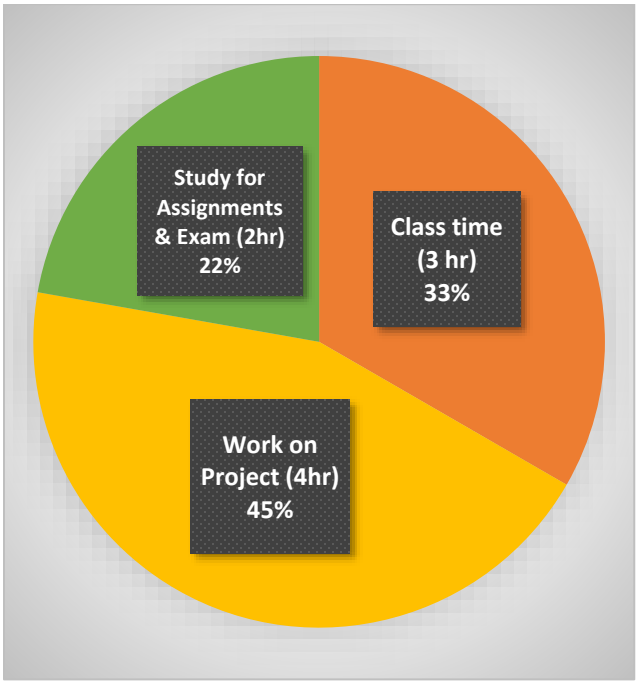

Figure 1. Weekly Invested Hours into the course

Recording of Class Sessions
Class sessions may be recorded by the instructor for use by students enrolled in this course. Recordings that contain personally identifiable information or other information subject to FERPA shall not be shared with individuals not enrolled in this course unless appropriate consent is obtained from all relevant students. Class recordings are reserved only for the use of students enrolled in the course and only for educational purposes. Course recordings should not be shared outside of the course in any form without express permission.

Your experience in this class is important to me. If you have already established accommodations with Student Accessibility Services, please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course. If you have not yet established services through SAS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but are not limited to: mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to please visit the SAR webpage at http://www.uttyler.edu/disabilityservices or call 903.566.7079. SAR offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s), and SAR. It is important to University of Texas at Tyler to create inclusive and accessible learning environments consistent with federal and state law.

NOTE: The syllabus is subject to change during the course of semester as deemed necessary.