



**MENG 4312 – System Dynamics and Control**  
**Course Syllabus**

<b>Semester / Year</b>	Fall 2024
<b>Catalog Description</b>	Dynamics of mechanical, electrical, thermal, fluid, and hybrid systems. System response using Laplace transform. Transfer functions. Transient response, Stability, Basic control algorithms, PID tuning methods, Frequency response, basic controller design and case studies.
<b>Prerequisites</b>	<b>MENG 3309, MENG 3211, and MENG 3316, and C or better in EENG 3304 (Linear Circuits Analysis) or equivalent like ENGR 2405</b>
<b>Section Number</b>	030
<b>Instructor Name</b>	Dr. M. A. Rafe Biswas
<b>Contact Information</b>	Email: <a href="mailto:mbiswas@uttyler.edu">mbiswas@uttyler.edu</a> Zoom ID: 903 566 6115 Office: HEC A214
<b>Class Type / Instruction Mode / Location</b>	Face-to-Face Lecture Houston Engineering Ctr A217 (details posted on Canvas)
<b>Class Time</b>	TTh 9:30 am to 10:50 am
<b>Office Hours</b>	TWTh 11:10 am to 12:20 pm or By appointment
<b>No. of Credits</b>	3
<b>Required Textbook</b>	Katsuhiko Ogata, System Dynamics, 4th Ed., Prentice Hall, 2003, but older editions are acceptable <a href="https://uttyler.bncollege.com/c/System-Dynamics/p/MBS_588545_new?currentCampus=782&amp;currentTerm=782_1_22_F&amp;currentCourse=782_1_22_F_200_4312_3">https://uttyler.bncollege.com/c/System-Dynamics/p/MBS_588545_new?currentCampus=782&amp;currentTerm=782_1_22_F&amp;currentCourse=782_1_22_F_200_4312_3</a>
<b>Optional References</b>	Recommended online textbook (available via library using patriots account) – - Mandal, Ajit K.. <i>Introduction to Control Engineering : Modeling, Analysis and Design</i> , New Age International Ltd, 2006. <i>ProQuest Ebook Central</i> , <a href="https://ebookcentral.proquest.com/lib/uttyler/detail.action?docID=395560">https://ebookcentral.proquest.com/lib/uttyler/detail.action?docID=395560</a> - Lobontiu, Nicolae. <i>System dynamics for engineering students: Concepts and applications</i> . Academic Press, 2017. (Elsevier website: <a href="https://www.sciencedirect.com/book/9780128045596/system-dynamics-for-engineering-students">https://www.sciencedirect.com/book/9780128045596/system-dynamics-for-engineering-students</a> ) Additional Material on Canvas: Websites, Class Handouts, Tutorials on MATLAB and Simulink by Mathworks, Inc.
<b>Additional Rules and Requirements</b>	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



	<p>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-generated 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.</p> <p><a href="http://journals.ieeeauthorcenter.ieee.org/wp-content/uploads/sites/7/IEEE_Reference_Guide.pdf">http://journals.ieeeauthorcenter.ieee.org/wp-content/uploads/sites/7/IEEE_Reference_Guide.pdf</a></p> <p>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.</p>						
<b>Evaluation Method</b>	<table> <tr> <td>Exam</td> <td>30%</td> </tr> <tr> <td>Assignments, Class Participation and Conduct</td> <td>30%</td> </tr> <tr> <td>Project</td> <td>40%</td> </tr> </table>	Exam	30%	Assignments, Class Participation and Conduct	30%	Project	40%
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<b>Grading Policy / Scale</b>	<p>Letter grades, scale: A: 90 – 100; B: 80 – 89; C: 70 – 79; D: 60 – 69; F: &lt; 60</p>						
<b>Important Events / Dates</b>	<p>Census date: September 9 Last date to withdraw from one or more 15-week courses: November 4 Final Project Report: December 4 Exam 3: Finals week (week of December 9)</p>						
<b>Attendance / Makeup policy / other rules</b>	<p>Attendance is expected per university policy. Attendance of lectures may be regularly checked using Canvas.</p> <p>Make-up exams or assignments if approved will be administered during finals week.</p> <p>No email submission of assignment(s). All assignments MUST be submitted to Canvas for grading.</p> <p>Student with SAR status should contact the UT Tyler Office of Student Accessibility and Resources for exam arrangements.</p> <p>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.</p> <p>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.</p> <p>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</p>						



	<p>not be given. However, students can work on the right solution by checking their work with the instructor.</p> <p>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.</p> <p>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.</p>
<b>Course Learning Objectives / ABET &amp; PEOs Relation</b>	<p>By the end of this course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Apply fundamental principles of dynamic systems to modeling.</li> <li>2. Analyze dynamics systems in time domain and frequency domain.</li> <li>3. Conduct the analysis and design of SISO control systems.</li> <li>4. Use computational tools to assist in the design and analysis of dynamics systems and pertinent controllers.</li> <li>5. Apply control system knowledge to real-world problems in case studies.</li> </ol>
<b>Tentative Topics / Course Plans</b>	<ul style="list-style-type: none"> <li>• Transfer-function modeling approach</li> <li>• State-space modeling approach</li> <li>• Time domain analysis of dynamic systems</li> <li>• Frequency domain analysis of dynamics systems</li> <li>• Time domain control design</li> <li>• Frequency domain control design</li> <li>• Self-directed project investigation.</li> </ul>
<b>University Policies</b>	<p><a href="https://www.uttyler.edu/offices/academic-affairs/files/syllabus-information.pdf">https://www.uttyler.edu/offices/academic-affairs/files/syllabus-information.pdf</a></p>



### Course Schedule

Week of	Chapter /Class Activity	Major Assignments due
Aug 26	Syllabus/ Chapter 1 & 2 Lecture/Appendices A – D	MATLAB tutorial completion credit
Sep 2	No lecture	Exam 1
9	Chapter 3 Lecture Transfer-function modeling	Project Guidelines
16	Chapter 4 Lecture Transfer-function modeling	
23	Chapter 4/5 Lecture State-space modeling	Scope Report
30	Chapter 5 Lecture State-space modeling	Simulink tutorial completion credit
Oct 7	Chapter 5/7 Lecture State-space modeling/ Thermal Fluid	
14	Chapter 6/8 Lecture Electrical modeling/Analysis	Simscape tutorial completion credit
21	Chapter 8 Lecture Time domain analysis	Exam 2
28	Chapter 8/9 Lecture Time/Frequency domain analysis	
Nov 4	Chapter 9/10 Lecture Time/Frequency domain analysis	Control Design tutorial completion credit
11	Chapter 10 Lecture Time domain analysis	Progress Report due
18	Chapter 10/11 Lecture - Time domain control design	
25	Thanksgiving Week - No Classes	
Dec 2	Chapter 11 Lecture Frequency domain control design	Final Project Report Due
9	Finals week (No classes)	Exam 3



## Evaluation activities

- **Exam:** There will be 3 Exams during the semester. Exam 1 is a review assignment that covers Differential Equations including Laplace Transform concepts. Exam 2 covers topics from 1<sup>st</sup> half of the semester. Exam 3 is comprehensive to also cover topics from 2<sup>nd</sup> half of the semester. 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 dynamic 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 3 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.

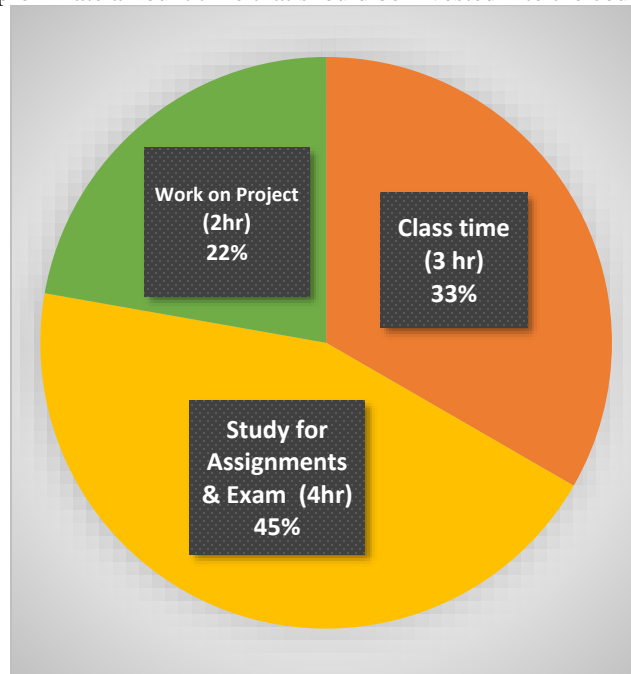


Figure 1. Weekly Invested Hours into the course



*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.