

**MENG 4312– System Dynamics and Control**

**Course Syllabus**

Semester / Year	Fall 2022
Catalog Description	This course introduces the fundamental concepts to model dynamic systems and to design basic control systems. The students will learn how to perform optimal and robust control design of dynamic systems. A software package will be selected for use as a learning support tool.
Prerequisites	<b>MENG 3309, MENG 3211, and MENG 3316, and C or better in EENG 3304 (Linear Circuits Analysis) or equivalent like ENGR 2405</b>
Section number	031
Instructor name	Dr. Mohammad A. Rafe Biswas
Contact info	Office: HEC A214 or via Zoom (details posted on Canvas) E-mail: <a href="mailto:mbiswas@uttyler.edu">mbiswas@uttyler.edu</a> Phone & Zoom ID: 903 566 6115
Class Type/Location	Houston Engineering Ctr B210 (details posted on Canvas)
Class Time	MW 5:30 – 6:55 PM
Office Hours	T 11:00 am to 12:30 pm and MW 2:30 to 3:30 pm or By appointment
Credit Hours	3 (3 hours lecture and 0 hours laboratory per week).
Required Textbook	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>
Optional References	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.
Additional requirements	MATLAB, Simulink & Simscape by MathWorks, Inc. (available through virtual desktop – one.uttyler.edu)
Evaluation Method	Grading: Exam 35% Assignments, Class Participation and Conduct 50% Project 15%

Grading Policy / Scale	<p>Letter grades</p> <p>Scale: A     90 – 100                  B     80 – 89                  C     70 – 79                  D     60 – 69                  F     &lt; 60</p> <p>Grade appeal: grades can be appealed by meeting the instructor during office hours, but no later than a week after the grade has been given.</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>									
Important events / dates	<p>Census date: Sept 2          Exam 1: Aug 31          Exam 2: Oct 12          Exam 3 (during Finals week): Dec 7</p>									
Attendance / Makeup policy	<p>Attendance and participation to lectures are expected per university's <a href="#">Class Attendance policy</a>. Any violation of the Student Behavior (see below) will result in 1% or more grade reduction for each incident. Students may appeal the grade reduction to the instructor if valid excuse or reason can be given. Make-up assignments if approved will be administered during finals week.</p>									
Course Learning Objectives / ABET & PEOs relation	<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>									
Topics	<ol style="list-style-type: none"> <li>1. Transfer-function modeling approach</li> <li>2. State-space modeling approach</li> <li>3. Time domain analysis of dynamic systems</li> <li>4. Frequency domain analysis of dynamics systems</li> <li>5. Time domain control design</li> <li>6. Frequency domain control design</li> </ol>									
Other	<p>Course schedule:</p> <table border="1" data-bbox="396 1562 1484 1894"> <thead> <tr> <th>Week of</th> <th>Chapter /Class Activity</th> <th>Major Assignments due</th> </tr> </thead> <tbody> <tr> <td>Aug 22</td> <td>Syllabus/ Chapter 1 &amp; 2 Lecture/Appendices A – D</td> <td>MATLAB tutorial completion credit/ <a href="#">Pre-Design Project Survey</a> by Sunday Aug 28</td> </tr> <tr> <td>29</td> <td>Chapter 3 Lecture Transfer-function modeling</td> <td>Exam 1/ Project &amp; Design Workshop Guidelines / Team Ideation Meetings for Project (Kick-Off)</td> </tr> </tbody> </table>	Week of	Chapter /Class Activity	Major Assignments due	Aug 22	Syllabus/ Chapter 1 & 2 Lecture/Appendices A – D	MATLAB tutorial completion credit/ <a href="#">Pre-Design Project Survey</a> by Sunday Aug 28	29	Chapter 3 Lecture Transfer-function modeling	Exam 1/ Project & Design Workshop Guidelines / Team Ideation Meetings for Project (Kick-Off)
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Sep	7	Chapter 3/4 Lecture Transfer-function modeling	Design Workshop Preparation #1 (Catapult Competition)
	12	Chapter 4 Lecture Transfer-function modeling	Simulink/Simscape tutorial completion credit
	19	Chapter 4/5 Lecture State-space modeling	Design Workshop Preparation #2 (Catapult Competition Lab Report) by Sept 20
	26	Chapter 5 Lecture State-space modeling	
Oct	3	Chapter 5/7 Lecture State-space modeling/ Thermal Fluid	
	10	Chapter 6/8 Lecture Electrical modeling/Analysis	Exam 2 /Design Workshop Preparation #3 (Catapult Competition Design Report / Video Presentation) by Oct 11
	17	Chapter 8 Lecture Time domain analysis	
	24	Chapter 8/9 Lecture Time/Frequency domain analysis	Design Workshop (Catapult Competition Testing and Product Display on Oct 29)
	31	Chapter 9/10 Lecture Time/Frequency domain analysis	Control Design tutorial completion credit
Nov	7	Chapter 10 Lecture Time domain analysis	Video Report 2 (Project Progress)
	14	Chapter 10/11 Lecture - Time domain control design	
	21	Thanksgiving Week - No Classes	
	28	Chapter 11 Lecture Frequency domain control design	
Dec	5	Finals week (No classes)	Exam 3
<u>Evaluation activities</u> ➤ Exams: There will be 3 timed Exams during the semester. 1st Exam is a review assignment that covers Differential Equations including Laplace Transform concepts. Exam 2 covers the material in first half of the semester and Exam 3 covers the material over the entire semester (comprehensive exam). No late submission will be accepted and will			

result in automatic grade of zero. Make-up exams/presentations if approved by instructor will be administered during finals week.

- Assignments (including Class Participation and Conduct): Check class and Canvas regularly for any announced assignments including Exams according to the topics covered in lectures. Short lecture videos on each topic or chapter will be posted on Canvas as announced for review to receive completion grade. 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, bringing textbook, taking notes, solving problems and participating in discussions, which are all expected.
- Project: Each student will be assigned a dynamic system for college level competition. Students collaborate with classmates to form a group (4-5 students) by informing the instructor no later than 2<sup>nd</sup> week of classes. Instructor will assign a set of complex dynamic system project for students to choose from. Each student/group analyzes the project and simulate the models of the subsystems and system using MATLAB and Simulink® to then submit technical documentation. The documentation form the project grade. Instructions on the documentation and project competition will be posted separately.

Note: Instructions on the written and oral report format/style, grading rubric and peer evaluation forms will be given separately on Canvas. Late submissions of assignments including project 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 (or 24 hours) from the graded score. All late assignments must be submitted on Canvas by last class day of the semester (before midnight). After that time, all late assignments will result in automatic grade of zero.

Student Behavior

- Academic dishonesty, in the form of cheating, fabrication, falsification, multiple submissions, plagiarism, and complicity, will not be tolerated. Regulations about academic dishonesty are contained in *A Student Guide to Conduct and Discipline at UT Tyler*, which may be obtained from the Office of Student Affairs.
- The Student Conduct and Lab Safety Form available electronically should be used to follow guidelines and will be used to assess part of Assignment grade.
- **The use of cellular phones during the class and lab is prohibited.**
- **No food or drink is allowed in the classroom or laboratories.**
- Student attitude: Given this is a professional, educational setting you are expected to dress and behave appropriately including wearing full pants and closed-toed shoes. A positive, mature attitude/behavior is expected from the students in all classes (lectures and laboratories). Students disturbing directly or indirectly the class or other students will be asked to leave the classroom or laboratory with the consequences associated to an absence.
- Students are encouraged to utilize any tutoring services available if needed and come prepared to each week's class and lab. Each student is expected to work with the group in a professional manner. It is important to communicate clearly and professionally of any concerns or issues to the instructor or lab assistant, who will relay to the instructor if they cannot be resolved independently.
- Canvas should be the primary mode of contacting the instructors so check the Canvas announcements and discussion board to check for information about the course. In addition, university provided patriots email should be official communication mode for topics outside the class and you should check your email regularly. If you email us, please allow up to 24

	<p>hours to respond on weekdays and 48 hours on weekends. If you call us and we don't answer, then please leave a voicemail with your name and reason for calling so we can call or email back. Otherwise the phone call will not be responded to.</p> <p>NOTE: The syllabus is subject to change during the course of semester as deemed necessary.</p>
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Figure 1 shows the recommended weekly hours to spend on this course. This is to be used as a guideline.

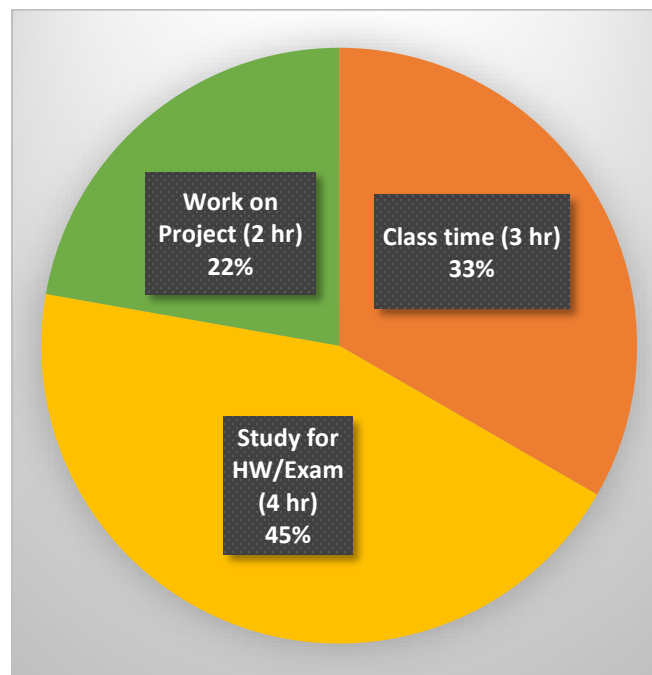


Figure 1. Weekly Invested Hours into the course

Note: *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.

**University, College, and Department Policies:**

**1. UT Tyler Honor Code**

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

## 2. Student Standards of Academic Conduct

Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, or material which has been submitted within a different course without explicit approval of the instructor, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

- i. “Cheating” includes, but is not limited to:
  - copying from another student’s test paper;
  - using, during a test, materials not authorized by the person giving the test;
  - failure to comply with instructions given by the person administering the test;
  - possession during a test of materials, or devices and instruments allowing access to materials, which are not authorized by the person giving the test, such as class notes or specifically designed “crib notes” as well as cell phones, to name a few. The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
  - using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
  - collaborating with or seeking aid from another student or person during a test or other assignment without explicit authorization;
  - discussing the contents of an examination with another student who will take the examination;
  - divulging the contents of an examination, for the purpose of preserving questions for use by another, or removing material from the exam location, when the instructors has designated that the examination is not to be removed from the examination room or not to be returned or to be kept by the student;
  - substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
  - paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
  - falsifying research data, laboratory reports, and/or other academic work offered for credit;
  - taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and
  - misrepresenting facts, including providing false grades or resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.
- ii. “Plagiarism” includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another’s work and the submission of it as one’s own academic work offered for credit.
- iii. “Collusion” includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.
- iv. All written work that is submitted will be subject to review by plagiarism software.

- v. Penalty for any related infractions will be decided at the discretion of the instructor including, but not limited to, granting of a failing grade in part or the course or in the entire course.

### **3. Students Rights and Responsibilities**

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: <http://www.uttyler.edu/wellness/rightsresponsibilities.php>

### **4. Important Covid-19 Information for Classrooms and Laboratories**

*It is important to take the necessary precautions to ensure a healthy and successful year. UT Tyler continues to urge you to protect yourselves against the flu, COVID and any new threats that may be developing. Be diligent about preventive measures such as washing hands, covering sneezes/coughs, social distancing and vaccinations, which have proven to be successful in slowing the spread of viruses. Encourage those who don't feel well to stay home, and if they show symptoms, ask them to get tested for the flu or COVID. Self-isolation is important to reduce exposure ([CDC quarantine/isolation guidelines](#)). Please work with your faculty members to maintain coursework and please consult [existing campus resources](#) for support.*

### **5. 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.

### **6. Campus Carry**

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at <http://www.uttyler.edu/about/campus-carry/index.php>

### **7. UT Tyler a Tobacco-Free University**

All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors.

Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless

tobacco, snuff, chewing tobacco, and all other tobacco products.

There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support.

For more information on cessation programs please visit [www.uttyler.edu/tobacco-free](http://www.uttyler.edu/tobacco-free).

### **8. Grade Replacement/Forgiveness and Census Date Policies**

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at <http://www.uttyler.edu/registrar>. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.

Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date is the deadline for many forms and enrollment actions of which students need to be aware. These include:

- Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

#### **9. State-Mandated Course Drop Policy**

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date).

Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

#### **10. Disability/Accessibility Services**

In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Texas at Tyler offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including a non-visible diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit <https://hood.accessiblelearning.com/UTTyler> and fill out the New Student application. The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director of Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at <http://www.uttyler.edu/disabilityservices>, the SAR office located in the University Center, # 3150 or call 903.566.7079.

The University of Texas at Tyler has a continuing commitment to providing reasonable accommodations for students with documented disabilities. Like so many things this Fall, the need for accommodations and the process for arranging them may be altered by the COVID-19 changes we are experiencing and the safety protocols currently in place. Students with disabilities who may need accommodation(s) in order



to fully participate in this class are urged to contact the Student Accessibility and Resources Office (SAR) as soon as possible, to explore what arrangements need to be made to ensure access. During the Fall 2020 semester, SAR will be conducting all appointments via ZOOM. If you have a disability, you are encouraged to visit <https://hood.accessiblelearning.com/UTTyler> and fill out the New Student Application. For more information, please visit the SAR webpage at <http://www.utt Tyler.edu/disabilityservices> or call 903.566.7079.

#### **11. Student Absence due to Religious Observance**

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

#### **12. Student Absence for University-Sponsored Events and Activities**

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

#### **13. Social Security and FERPA Statement**

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

#### **14. Emergency Exits and Evacuation**

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

#### **15. UT Tyler Resources for Students**

- UT Tyler Writing Center (903.565.5995), [writingcenter@utt Tyler.edu](mailto:writingcenter@utt Tyler.edu)
- UT Tyler Tutoring Center (903.565.5964), [tutoring@utt Tyler.edu](mailto:tutoring@utt Tyler.edu)
- The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
- UT Tyler Counseling Center (903.566.7254)