The University of Texas at El Paso
Department of Civil Engineering
Fall 2025

COURSE INFORMATION

CE5390 Systems Approach to Civil Engineering Problem
Term: Fall 2025
Delivery Method: Classroom lecture
Meeting Day and Time, Location: 3:00 pm - 4:20 pm, TR, Engineering, A227

INSTRUCTOR INFORMATION

Instructor: Rajib B. Mallick
Written Communication: email, rbmallick@utep.edu
Phone Number: (915)747 8699
Office Location: Engineering Building, A216
Office Hours:

- Face-to-Face: By appointment only, please email me
- Virtual: By appointment only through MSTeams

COURSE DESCRIPTION

This course will be offered to teach a "Systems" approach to help us evolve and develop our capabilities of learning, communicating, and researching, by "System Dynamics" modeling, and experimentation through simulation of models that are relevant to Civil Engineering.

Topics:

- Overview
  - The system as a cause
  - Why do we need System Dynamics?
- How to model a problem
  - Modeling as a Tool
- Relationships between variables
  - Modeling A Problem with Stocks, Flows, and Converters
  - How do we characterize model trends?
    - Exponential
    - Goal seeking
    - Oscillation
    - S shaped growth
- Converting ordinary differential equations to system dynamics problems
- Dynamic systems – examples and modeling
  - Dynamics in Pavements
- Closed loop - examples and modeling
- Cascading Effects
  - Modeling
  - Simulation
  - Extension of the model
  - Incorporating variability in the model

    - Exploring solutions
- Feedback Causal System
    - Problem
    - Model
    - Simulation
- Complex, Nonlinear systems - examples and modeling
    - Defining The Key Sectors and Parameters
        - Step 1. Identify the key sectors
        - Step 2: Mapping of the sectors with parameters
        - Step 3: Defining the relationships between the parameters
        - Step 4: Combining Sectors and Running the Model
        - Composite Index
- Concepts of sustainability
    - Example model
- Concepts of Vulnerability, Risk and Resilience
    - Example model
- Probabilistic Simulation with System Dynamics
    - Problem Definition
    - Considerations
    - Steps
    - Monte Carlo simulation with system dynamics
    - Applications in Resilience and Sustainability in Civil Engineering
- System of Systems
    - Problem Definition
    - Steps
    - Example Model of a coastal airport
- System Dynamics – Path Forward
    - Ideal steps for creating and using a System Dynamics model
    - Systems Science, systems engineering, and System Dynamics
    - Limits to growth theory
    - Use of System Dynamics, source of information, and suggested readings

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COURSE OBJECTIVES AND UNIVERSITY LEARNING OUTCOMES

By the end of the course, students will be able to:

Student Learning Objective	Outcome
Work as part of a team to collect data for the development of a system dynamics model	Teamwork Skills
Analyze data to model a problem and predict future conditions	Critical Thinking Skills
Communicate with stakeholders regarding the outcomes of modeling with appropriate visuals and text	Communication Skills
Identify and compare concepts and processes for Resilience and Sustainability in Civil Engineering	Social Responsibility

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REQUIRED MATERIALS

Materials will be provided, reference texts:

1. Access to STELLA software (will be provided)
2. https://iseesystems.com/resources/help/v3/default.htm
3. Class notes
4. Reference materials:
    a. Andrew Ford, Modeling the Environment, Second Edition Second Edition, ISBN-13: 978-1597264730
    b. Sterman, John. 2000. Business dynamics: systems thinking and modeling for a complex world. Boston: Irwin/McGraw-Hill.
    c. Forrester, J. W. Principles of systems 1969. Principles of systems. Principles of systems. Cambridge, Mass.
    d. Forrester, J. W. 1961. Industrial dynamics. M.I.T. Press Cambridge, Mass
    e. R. B. Mallick, System Dynamics for Complex Problems in Pavement Engineering; 12-chapter book. CRC Press/Taylor Francis, 2023. ISBN 9781032382906

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*ASSIGNMENTS AND GRADING

2 Examinations and 1 Project
Exam 1: (25%); 9/16/25 (tentative)
Exam 2: (25%): 11/6/25 (tentative)
Final Project (50%) (Teams, with 2 students in each): Model on Resilience and Sustainability in Civil Engineering
Due by 12/10/25.

Grade Distribution:
100-90 = A 89-80 = B 79-70 = C 69-60 = D 59 and Below = F

TECHNOLOGY REQUIREMENTS

Some course content is delivered via the Internet through the Blackboard learning management system. Ensure your UTEP e-mail account is working and that you have access to the Web and a stable web browser. Google Chrome and Mozilla Firefox are the best browsers for Blackboard; other browsers may cause complications. When having technical difficulties, update your browser, clear your cache, or try switching to another browser.

You will need to have access to a computer/laptop. You will need to download or update the following software: Microsoft Office, Adobe Acrobat Reader, and Windows Media Player. Check that your computer hardware and software are up-to-date and able to access all parts of the course. Access to STELLA (software for system dynamics) will be provided.

If you do not have word-processing software, you can download Word and other Microsoft Office programs (including Excel, PowerPoint, Outlook and more) for free via UTEP's Microsoft Office Portal. Click the following link for more information about Microsoft Office 365 and follow the instructions.
IMPORTANT: If you encounter technical difficulties beyond your scope of troubleshooting, please contact the UTEP Help Desk as they are trained specifically in assisting with

technological needs of students. Please do not contact me for this type of assistance. The Help Desk is much better equipped than I am to assist you!

COURSE COMMUNICATION:

Email: UTEP e-mail is the best way to contact me. I will make every attempt to respond to your e-mail within 24 hours of receipt. When e-mailing me, be sure to email from your UTEP student e-mail account and please put the course number in the subject line. In the body of your e-mail, clearly state your question. At the end of your e-mail, be sure to put your first and last name, and your university identification number.

- Announcements: Check the Blackboard announcements frequently for any updates, deadlines, or other important messages.

ATTENDANCE AND PARTICIPATION

Our class meetings are in-person at Classroom Building C304, Tuesday and Thursday, 3 – 4:20 pm beginning August 26 (**first day of the class is on August 27**) through December 5. Attendance on the course is determined by participation in the learning activities of the course. Your participation in the course is important not only for your learning and success but also to create a community of learners.

ILLNESS PRECAUTIONS

Please stay home if you have symptoms of a communicable illness. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodation.

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*EXCUSED ABSENCES AND/OR COURSE DROP POLICY

According to UTEP Catalog, "At the discretion of the instructor, a student can be dropped from a course because of excessive absences or lack of effort. A grade of "W" will be assigned before the course drop deadline and a grade of "F" after the course drop deadline." See Policies and Regulations in the UTEP Undergraduate Catalog for a list of excuse absences. Therefore, if I find that, due to non-performance in the course, you are at risk of failing, I will drop you from the course. I will provide 24 hours advance notice via email.

OR

I will not drop you from the course. However, if you feel that you are unable to complete the course successfully, please let me know and then contact the Registrar's Office to initiate the drop process. If you do not, you are at risk of receiving an "F" for the course.

DEADLINES, LATE WORK, AND ABSENCE POLICY

No late work will be accepted if the reason is not considered excusable.

MAKE-UP WORK

Make-up work will be given *only* in the case of a *documented* emergency. Note that make-up work may be in a different format than the original work, may require more intensive preparation, and may be graded with penalty points. If you miss an assignment and the reason is not considered excusable, you will receive a zero. It is therefore important to reach out to me—in advance if at all possible—and explain with proper documentation why you missed a given course requirement. Once a deadline has been established for make-up work, no further extensions or exceptions will be granted.

ALTERNATIVE MEANS OF SUBMITTING WORK IN CASE OF TECHNICAL ISSUES

I strongly suggest that you submit your work with plenty of time to spare in the event that you have a technical issue with the course website, network, and/or your computer. I also suggest you save all your work in a separate Word document as a backup. This way, you will have evidence that you completed the work and will not lose credit. If you are experiencing difficulties submitting your work through Blackboard, please contact the UTEP Help Desk. You can email me your backup document as a last resort.

INCOMPLETE GRADE POLICY

Incomplete grades may be requested only in exceptional circumstances after you have completed at least half of the course requirements. Talk to me immediately if you believe an incomplete is warranted. If granted, we will establish a contract of work to be completed with deadlines.

***ACCOMMODATIONS POLICY**

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services and activities with documented disabilities in order to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship on the University. Students requesting an accommodation based on a disability must register with the UTEP Center for Accommodations and Support Services (CASS). Contact the Center for Accommodations and Support Services at 915-747-5148, email them at cass@utep.edu, or apply for accommodations online via the CASS portal.

***SCHOLASTIC INTEGRITY**

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as ones' own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the Office of Student Conduct and Conflict Resolution (OSCCR) for possible disciplinary action. To learn more, please visit HOOP: Student Conduct and Discipline.

***GUIDANCE ON ARTIFICIAL INTELLIGENCE**

The use of generative AI tools such as Chat GPT is permitted in this course, which must be noted or cited. Students must cite any borrowed content sources to comply with all applicable citation

guidelines, copyright law, and avoid plagiarism. Instances that violate these guidelines will be referred to the Office of Student Conduct and Conflict Resolution.

PLAGIARISM DETECTING SOFTWARE

Some of your course work and assessments may submitted to SafeAssign, a plagiarism detecting software. SafeAssign is used review assignment submissions for originality and will help you learn how to properly attribute sources rather than paraphrase.

***COURSE RESOURCES:** Where you can go for assistance

UTEP provides a variety of student services and support:

Technology Resources

- Help Desk: Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or in person if on campus.

Academic Resources

- UTEP Library: Access a wide range of resources including online, full-text access to thousands of journals and eBooks plus reference service and librarian assistance for enrolled students.
- University Writing Center (UWC): Submit papers here for assistance with writing style and formatting, ask a tutor for help and explore other writing resources.
- Math Tutoring Center (MaRCS): Ask a tutor for help and explore other available math resources.
- History Tutoring Center (HTC): Receive assistance with writing history papers, get help from a tutor and explore other history resources.
- RefWorks: A bibliographic citation tool; check out the RefWorks tutorial and Fact Sheet and Quick-Start Guide.
- The Miner Learning Center: Join peer-led study sessions in person or online to review content and discover study strategies in core curriculum courses.
- UTEP Edge: UTEP's cross-campus framework for student success and empowerment – develops students' assets through high-impact experiences made possible by the expertise and dedication of faculty, staff, alumni, and community partners.

Individual Resources

- Student Success Help Desk (SSHD): Students experiencing challenges or obstacles to academic success including registration, financial, food, housing, and transposition resources my submit a ticket request assistance to studentsuccess@utep.edu
- Military Student Success Center: Assists personnel in any branch of service to reach their educational goals.
- Center for Accommodations and Support Services: Assists students with ADA-related accommodations for coursework, housing, and internships.
- Counseling and Psychological Services: Provides a variety of counseling services including individual, couples, and group sessions as well as career and disability assessments.

- UTEP Food Pantry: Non-perishable food items are available to students who are currently enrolled in classes. Bring a Miner Gold Card to Memorial Gym, Room 105, Monday through Friday, 10 a.m. to 2 p.m.