University of Texas at Tyler
Department of Civil and Construction Engineering and Management
Course Syllabus

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Course number and name
CENG 5399-031 Independent Study

Lecture Time & Venue
Meeting Time(s): Weekly meetings on Wednesday from 10:00 AM to 11:00 AM are expected throughout the semester.

Course Number and Section: CENG 5399, Section 031 (HEC Campus)

Classroom Number(s): TBA

Instructor Information
Instructor Name: Dr. Zain Al-Houri
Office Number: HEC A211
Email: zalhouri@uttyler.edu
Office Hours (In Person):
M/W 10:00 AM – 11:00 AM,
T/Th 11:15 AM – 12:15 PM or by appointment (BEST PRACTICE of contact is either **to send me an email through Canvas** or from your Patriots account

Course Website
Canvas will be used to manage the course material for the semester. All course materials and announcements will be provided in Canvas. **Please check there regularly.**

Specific course information
The specific research goals will be different for each independent researcher and will be established by the student and the supervising instructor. However, the primary goal of the course is to provide students with research exploration of a specific topic of interest to the individual student under the advisement of an instructor who will monitor and critique the student's progress.

Course Description
Welcome to CENG 5399 (Independent Study). During the upcoming semester, this course brings student and faculty together to focus on best research practices. These include identifying fruitful research questions, choosing appropriate research methodologies, conducting literature reviews, designing studies, analyzing data, building theory, writing research papers, and presenting work to the professional community. The course will meet once a week. The details of its structure will be determined by the lead faculty.

This class is not lecture-based but rather is driven by student interests. Class sessions will consist of activities such as student presentations, discussions on research topics, or guided reading discussions on topics in research. The group will meet at the start of the semester to determine the topics, timeline, and format (presentation, discussion, workshop, etc.). You will conduct an in-depth study/research on a topic of your choice and craft a project of significant value to the field of study. The student will meet with the instructor regularly to discuss progress, revision, and prepare a final report about the research conducted.

Textbook, title, author, and year
Independent study with curated readings, datasets, and open-source resources
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Grading Breakdown

Grades are based on individual meeting participation, assignment completion, and the quality of work.

Grades:	**Grade: Scale**
Attendance of Weekly Meeting = 10%	A: 90-100
Research Proposal = 10%	B: 80-89
Presentation (maybe poster at a conference) = 30%	C: 70-79
Final Report (maybe a conference or journal paper) = 50 %	D: 60-69

Specific goals for the course

1. Collect and preprocess real-world datasets (water consumption, weather, population).
2. Apply statistical and machine learning methods to forecast water demand.
3. Compare models and identify key influencing factors in water demand.
4. Communicate findings in both written (research paper) and oral (presentation) formats.
5. Demonstrate engineering judgment by evaluating the societal and environmental impact of accurate water demand forecasting.

Topics covered (In this semester)

a. Data collection & preprocessing (Excel, Python, open datasets).
b. Exploratory data analysis & visualization.
c. Statistical models: linear regression
d. Machine Learning Models
e. Model evaluation: R^2, RMSE, MAE, cross-validation.
f. Feature importance and interpretation.
g. Forecasting and uncertainty analysis.
h. Ethical, societal, and environmental implications of water demand modeling.
i. Research writing and presentation skills.

Attendance:

Attendance and preparedness for weekly meetings with Dr. Al Houri are expected to receive full credit for this portion of your final grade. In the weekly progress meetings, we will discuss accomplishments from the previous weekly meeting, any potential issues, and tasks to be completed by the subsequent weekly progress meeting.

Presentation:

The student is required to give a presentation on the research topic investigated in the period of this course. The presentation and the paper will count towards 30% of your grade.

End-of-Semester Final Report (Research Paper)

At the end of the semester, the students are required to submit a final report (or research paper). The Report (research paper) should include the following chapters/sections.

1) Executive Summary
2) Introduction
3) Case Study
4) Methodology
5) Results

6) Discussion
7) Conclusion
8) References
9) Appendix

Final Day to Withdraw

The final day to withdraw from the course without penalty is **Sep 17th.**

The last day to withdraw from the course is **Nov 03.**

Census Dates

The university requires that instructors report the attendance to the register at various points in the semester. Therefore, on **September 8th**, I will report the attendance for the class.

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 thosewho do.

Chat GPT or other AI sources

Students may use AI-based writing programs only for homework assignments, and any AI-generated content must be properly cited or referenced. The use of AI tools on exams or quizzes is strictly prohibited. Unauthorized use will be considered cheating according to the Academic Dishonesty policy below.

Academic Misconduct

Plagiarism of homework and cheating on examinations will be interpreted as academic misconduct and will not be tolerated. Please refer to the University of Texas at Tyler current Undergraduate Catalog for academic policies and Manual of Policies and Procedures for Student Affairs (MOPPS, Chapter 8) regarding academic integrity, cheating and plagiarism. Academic dishonesty will not be tolerated. Ignorance of the rules and policies provides no protection from the consequences.

Technical Support

For technical problems with Canvas, contact UT Tyler 24/7 Canvas Support, which can be accessed by clicking Help at the bottom of the Global Navigation menu on the far-left side of the browser window. For login/password problems or support for other technical issues, contact Campus Computing Services at 903-565-5555 or itsupport@uttyler.edu.

University Policies & Student Resources

University policies and student resources are available on the University website and in Course home page on Canvas:

- University Policy
- Student Resources

TENTATIVE COURSE SCHEDULE

The following schedule may be adjusted, as needed, during the semester to better serve the educational needs of the class.

Week #	Topic	Readings	Homework* (Assigned)
WK 1	Course Introduction	Syllabus	
WK 2	**LABOR DAY**		Draft study goals, identify datasets Review research scope
	Orientation & Project Selection	Draft study goals, identify datasets	
WK 3	Data Acquisition	Collect water use, weather, and population data	Present initial dataset & cleaning plan
WK 4	Data Exploration	Perform descriptive stats & plots	Discuss trends, anomalies, and gaps
WK 5	Regression Models	Implement baseline linear regression	Review of model results & errors
WK 6	Time Series Models	Explore ARIMA/SARIMA	Compare regression vs. time series
WK 7	Model Evaluation	Cross-validation & error metrics	Discuss preliminary results
WK 8	ML Models	Implement decision tree & random forest, Train gradient boosting	Review performance & feature splits, Compare ML vs. statistical methods
WK 9	Neural Networks	Implement MLP/LSTM (time series)	Discuss setup & early results
WK 10	Feature Analysis	Conduct a feature importance study	Interpret key drivers of demand
WK 11	Draft Results	Write the results section of the paper	Feedback on draft & figures
WK 12	Forecasting	Generate future predictions	Review forecast plots & implications
WK 13	**THANKSGIVING BREAK (11/24 - 11/28)**		
WK 14	Paper & Presentation Prep	Complete draft paper & slides	Peer/mentor review of final deliverables
WK 15	Final Presentation	Submit final paper (15–20 pages)	Deliver oral presentation & wrap-up

Student Learning Outcomes

At the completion of the program, students should be able to	
SO 1	Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
SO 2	Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
SO 3	Communicate effectively with a range of audiences
SO 4	Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
SO 5	Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
SO 6	Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
SO 7	Acquire and apply new knowledge as needed, using appropriate learning strategies

Mapping Course to Student Learning Outcomes

The learning outcomes of this course contribute to meeting one or more of the student learning outcomes as shown below, with the contribution designated as "H-high", "M-medium", or "L-low":

	SO1	**SO2**	**SO3**	**SO4**	**SO5**	**SO6**	**SO7**
CLO 1	H	M	L	M	L	H	H
CLO 2	H	H	L	M	L	H	H
CLO 3	H	H	M	M	L	H	M
CLO 4	M	M	H	M	M	M	M