FLORIDA ATLANTIC UNIVERSITY

NEW COURSE PROPOSAL
Undergraduate Programs

Department Civil, Environmental and Geomatics Engineering

College Engineering & Computer Science

*(To obtain a course number, contact **erudolph@fau.edu**)*

UUPC Approval 10/9/2023
UFS Approval
SCNS Submittal
Confirmed
Banner Posted
Catalog

Prefix CGN

Number 4332

(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)

Lab Code

Type of Course: Lecture

Course Title: RI: Data-driven Civil Infrastructure

Credits *(See Definition of a Credit Hour)*: 3

Effective Date *(TERM & YEAR)*: Spring 2024

Grading *(Select One Option)*
- **Regular** ◉
- **Sat/UnSat** ○

Course Description *(Syllabus must be attached; see Template and Guidelines)*

This course will cover data-driven infrastructure design, sensor-data analytical approaches, and technological applications with civil infrastructure management and planning for smart cities. Throughout this course, students are expected to learn how to ethically analyze real-world datasets collected from civil infrastructures and have access to various time-series data and spatiotemporal data (e.g., vibration data, temperature, images, trajectories).This is a research-intensive (RI) course.

Prerequisites, with minimum grade*
N/A
EGN 2213 Computer Applications in Engineering 1, minimum grade C

Corequisites
N/A

Registration Controls *(Major, College, Level)*

Default minimum passing grade is D-.** **Prereqs., Coreqs. & Reg. Controls are enforced for all sections of course

WAC/Gordon Rule Course

☐ **Yes** ☑ **No**

WAC/Gordon Rule criteria must be indicated in syllabus and approval attached to proposal. See WAC Guidelines.

Intellectual Foundations Program (General Education) Requirement *(Select One Option)*

None

General Education criteria must be indicated in the syllabus and approval attached to the proposal. See Intellectual Foundations Guidelines.

Minimum qualifications to teach course

Ph.D. with graduate-level education in closely related field

Faculty Contact/Email/Phone

Jinwoo Jang/jangj@fau.edu/7-2987

List/Attach comments from departments affected by new course

Approved by		***Date***
Department Chair	EKaijar	09/08/2023
College Curriculum Chair	Hongbo Su	09/25/2023
College Dean		9/25/23
UUPC Chair	Korey Sorge	10/9/2023
Undergraduate Studies Dean	Dan Moeroff	10/9/2023
UFS President		
Provost		

Email this form and syllabus to mjenning@fau.edu seven business days before the UUPC meeting.

Department of Civil, Environmental & Geomatics Engineering
Florida Atlantic University
Course Syllabus

1. Course title/number, number of credit hours	
RI: Data-driven Civil Infrastructure (CGN 4332)	3 credit hours
2. Course prerequisites, corequisites, and where the course fits in the program of study	
EGN 2213 Computer Applications in Engineering 1, minimum grade C	
3. Course logistics	
Term: Spring 2024 *Location: TBD* *Time: TBD*	
4. Instructor contact information	
Instructor's name *Office address* *Office Hours* *Contact telephone number* *Email address*	Dr. Jinwoo Jang EE 314 TBD 561.297.2987 jangj@fau.edu
5. TA contact information	
TA's name *Office address* *Office Hours* *Contact telephone number* *Email address*	TBD
6. Course description	
This course will cover data-driven infrastructure design, sensor-data analytical approaches, and technological applications with civil infrastructure management and planning for smart cities. Throughout this course, students are expected to learn how to ethically analyze real-world datasets collected from civil infrastructures and have access to various time-series data and spatiotemporal data (e.g., vibration data, temperature, images, trajectories). This is a research-intensive (RI) course. This course contains multiple assignments designed to help students conduct research and inquiry at an intensive level. If this class is selected to participate in the university-wide assessment program, students will be asked to complete a consent form and submit electronically some of their research assignments for review. Visit the Office of Undergraduate Research and Inquiry (OURI) for additional opportunities and information at http://www.fau.edu/ouri.	
7. Course objectives/student learning outcomes/program outcomes	
Course objectives	This course aims to cover fundamental concept of data analytics and visualization techniques with an emphasis on smart city research.
Student learning outcomes & relationship to ABET 1-7 objectives	A. An ability to analyze time-series data (1,6) B. An ability to analyze spatial data (1,6) C. An ability to visualize spatiotemporal data (6) D. An ability to perform data pattern mining (1, 6, 7) E. An ability to understand privacy concerns in data (4) F. An ability to perform open-ended research project as a team (3, 5, 7)

Relationship to program educational objectives	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics – High
	An ability to communicate effectively with a range of audience - High
	An ability to 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 - Medium
	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives - High
	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions - High
	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies - High

8. Course evaluation method (note percentages subject to change)

Homework	30%	*Note*: The minimum grade required to pass the course is "C."
Midterm	20%	
Final Team project	50%	

Homework (30%)
All homework must be completed individually in a neat and clear manner. Students must provide a document that includes source codes, program outputs, and detailed explanations and discussion. It is also encourage to provide detailed comments on each line of codes. Students must electronically submit their homework through Canvas.

Midterm (20%)
Examinations will be based on lectures and homework. The exams might include multiple choice, true/false, and/or short answer questions, calculations, and writing pseudo codes. Answers will be evaluated based on content in terms of accuracy of information and ability to solve data science problems. Good answers will demonstrate that you have read and understood the course materials. The test will be timed. Participation in University-approved activities or religious observances, with prior notice, will not be penalized. Keep copies of all quizzes and homework assignments for ABET purposes.

Final Team Project (50%)
A final team project is a collaborative effort to address public-interest research topics that leverage various data sources. The grade of a final project will be based on 1) project proposal – 10%, 2) OURI application – 5%, 3) Oral presentation – 15%, and 4) Final report – 20%. Strong team science and interactions with team members are encouraged. Potential research topics include pattern mining of FDOT open data, 2) mobile sensing data analytics, and 3) machine vision for situation awareness.

* Instructor will consider team leader's and peer's feedback on his evaluation.

Additional Note on Peer & Instructor Evaluation Criteria
Each student will be evaluated based on his/her

- attendance at and constructive participation in group discussions
- contribution to a fair share of the workload
- quality of work done
- completing work on time
- willingness to volunteer/accept tasks that need to be accomplished
- ability to arrange personal schedules to fulfill commitments to the team

The students will work in a group, but each group separates the project with sub-tasks led by each group member, who has a specific role (leader, accountant, mechanical/electrical part leader, etc.). The work progress and performance for each individual member will be evaluated by the course instructor and peer students in written progress reports and oral presentations.

9. Course grading scale

Grading Scale:
A: 90-100; A-: 85-89; B+: 80-84; B: 75-79; B-: 70-74; C+: 65-69; C: 60-64; C-: 55-59; D+: 50-54; D: 40-49
F: less than 40

This grading scale might be modified and curved based on the overall performance of students.

10. Policy on makeup tests, late work, and incompletes

1. *Exams* will be given only at the scheduled times and places, unless previous arrangements have been made no less than one (1) full week in advance. No one is exempt from exams.
2. *Makeup tests are given only if there is solid evidence of a medical or otherwise serious emergency that prevented the student of participating in the exam. Makeup exam should be administered and proctored by department personnel unless there are other pre-approved arrangements.*
3. *All homework will be completed individually in a neat and clear manner* All assignments are due by 11:59 pm on the due date indicated in the course schedule. *Late policy: 10 points off for the first day; 20 points off for the second day; and maximum 50 points after a solution is posted.*
4. *Late project is not acceptable.*
5. *Incomplete grades are against the policy of the department. Unless there is solid evidence of medical or otherwise serious emergency situation incomplete grades will not be given.*

11. Special course requirements

Some computer design problems based on MATLAB will be assigned. Although familiarity with MATLAB will be helpful, it is not a requirement.

- Projects are expected to achieve all six of the following OURI Student Learning Outcomes (SLOs):
  - SLO 1: Knowledge. Students are expected to demonstrate content knowledge, and knowledge of core principles and skills.
  - SLO 2: Formulate Questions. Students are required to formulate research questions, scholarly or creative problems in a manner appropriate to the planning discipline.
  - SLO 3: Plan of Action. Students are expected to develop and implement a plan of action to address research and inquiry questions or scholarly problems.
  - SLO 4: Critical Thinking. Students are expected to apply critical thinking skills to evaluate information, their own work, and the work of others.
  - SLO 5: Ethical Conduct. Students are expected to identify significant ethical issues in research and inquiry and/or address them in practice.
  - SLO 6: Communication. Students will convey all aspects of their research and inquiry (processes and/or products) in appropriate formats, venues, and delivery modes

OURI Student Learning Outcomes (SLO)	**Description of Assignment Requirements and Assessments**
LO 1: Knowledge	Students will demonstrate a fundamental basis of discipline-specific knowledge required for effective professional practice in the fields of computer and electrical engineering. Students will also demonstrate working knowledge of tools and practical skills needed to analyze engineering design problems related to multiple realistic constraints, such as environmental issues, engineering economics, design codes, ethics, and/or other contemporary design issues.
SLO 2: Formulate Questions	Students will develop and refine a problem statement in which they specifically address their research questions. Students are expected to articulate the scope of the problem to be able to address the research question with an engineering solution. When appropriate, students should be able to create additional (albeit related) questions for smaller subsections of the overall design project
SLO 3: Plan of Action	Students will create a plan of action that will include the problem statement (or research question), scope of work, literature review and background context, methodology or approach to the solution, analysis plan, conclusion and design documents. Students will develop a hypothesis if needed, identify research methods and alternative designs, and select appropriate statistical techniques, if warranted.

SLO 4: Critical Thinking	Students will demonstrate critical thinking skills by taking into consideration multiple perspectives and examining implications and consequences of design decisions or engineering alternatives. Students will also demonstrate an ability to use evidence and reasoning to objectively justify decisions and an ability to apply codes and design standards to make reasonable engineering judgments. Students are asked to peer review student work and provide feedback during the juried presentations.
SLO 5: Ethical Conduct	Students will familiarize themselves with the Code of Ethics of their engineering discipline. All work is held to the standards established by the governing professional societies of ocean and mechanical engineering disciplines.
SLO 6: Communication	Students will present and defend their work in written and oral formats (proposal and final report). All deliverables are expected to be of professional quality. Students are expected to demonstrate knowledge of technical report writing, graphical visualization, and persuasive presentation skills.

12. Classroom etiquette policy

University policy requires that in order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular phones, are to be disabled in class sessions.

13. Attendance policy statement

Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance.

Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations or participation in University-approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

14. Disability policy statement

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

15. Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to http://www.fau.edu/counseling/.

16. Code of Academic Integrity policy statement

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Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001.
www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf

17. Required texts/reading

MATLAB: A Practical Introduction to Programming and Problem Solving, 6th Edition, by Dorothy C. Attaway
Paperback ISBN: 9780323917506, eBook ISBN: 9780323986113, Elsevier, 2022

18. Supplementary/recommended readings

Fundamentals of Data Science with MATLAB: Introduction to Scientific Computing, Data Analysis, and Data Visualization, by Arash Karimpour
ISBN-13 978-1735241012, ISBN-10: 1735241016, Arash Karimpour, 2020.

19. Course topical outline, including dates for exams/quizzes, papers, completion of reading

1. Introduction to smart cities/infrastructure
2. Ethics in Data-driven Technologies
3. Time-series data in civil engineering
4. Spatial data of civil infrastructure
5. Image data in civil engineering
6. State-of-the-art data-driven applications for civil infrastructure
7. Project proposal development and assignment
8. Measurement noise
9. Introduction to regression analysis
10. Fundamental statistical analysis
11. Case studies and final reports
12. Oral presentations by students

Tentative Due Dates

Midterm Exam: 3/16/23 OURI Application: 4/02/23
Project Proposal: 3/26/23 Final Project Report: 4/20/23 Oral Presentations: 4/20-4/30/23