



**UNIVERSITY
OF ALBERTA**

**Civ E 779 – Future Infrastructure Systems
(in Sustainable and Resilient Smart Cities)**

Winter 2026

*Department of Civil and Environmental Engineering
University of Alberta*

Course Information

Instructors: Dr. Maziar Jamshidi and Dr. Mustafa Gül

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Lecture Time and Location: Fri 11:00-13:50, NRE 2-122

Office Hours: Fri 14:00-16:00, and by appointment. (DICE 7-358)

Land Acknowledgement: The University of Alberta respectfully acknowledges that we are located on Treaty 6 territory, a traditional gathering place for diverse Indigenous peoples including the Cree, Blackfoot, Métis, Nakota Sioux, Iroquois, Dene, Ojibway/ Saulteaux/Anishinaabe, Inuit, and many others whose histories, languages, and cultures continue to influence our vibrant community.

Course Description: This highly interdisciplinary course introduces emerging concepts and technologies within the framework of sustainable and resilient smart cities. It offers a broad overview of future cities and their key components, including Future Infrastructure Systems, Future Energy Systems, and Future Mobility Systems. The course places particular emphasis on Future Infrastructure Systems (FIS), exploring their sustainability and resiliency. Topics covered include sensing technologies, data analytics, artificial intelligence (AI), and the interdependencies, operation, management, and decision-making processes crucial for the development and maintenance of FIS.

Student Learning Outcomes: Upon completion of the course, students will be able to:

1. Identify the main components of FIS and their roles in developing sustainable and resilient smart cities.
2. Apply recent advances in emerging technologies, such as sensing, data analytics, and AI, to challenges related to FIS.
3. Describe the requirements for adapting existing infrastructure systems to future cities, with a focus on sustainability and resilience in the face of climate change.
4. Analyze the interdependencies within FIS.
5. Explain the requirements for enhancing the resilience of FIS.

Textbook information:

The course will be based on course material prepared and distributed by the instructor. Additional reference material will include research papers and reference textbooks (which are not mandatory). A tentative list for such reference text is provided below (subject to change).

- The Rise of Smart Cities - Advanced Structural Sensing and Monitoring Systems, Paperback ISBN: 9780128177846, eBook ISBN: 9780128177853
- Data Analytics for Smart Cities, ISBN 9781032475967
- Urban Engineering for Sustainability, by Dr. Sybil Derrible and published by MIT Press, ISBN: 9780262043441
- Smart Cities: Foundations, Principles, and Applications, First Edition, by Houbing Song, Ravi Srinivasan, Tamim Sookoor, Sabina Jeschke, and published by Wiley Publishing, ISBN 9781119226390
- Smart Cities: The Internet of Things, People and Systems, First Edition, by Schahram Dustdar, Stefan Nastić, and Ognjen Šćekić, and published by Springer Publishing, ISBN 9783319600307

Marking Scheme:

Assignments (5)	20%
Quizzes (3)	20%
Midterm project (report)	25%
Final project (report and presentations)	35%

Course Conduct

- Academic integrity is expected from all students in all matters related to this course. Each student assumes responsibility for every assignment/report/exam that they submit.
- Late submission for assignments and projects will not be accepted except for emergency situations.
- Assignments and project reports should be prepared in a professional format, clearly explaining the assumptions, solution methods, and the results with clear sketches/figures where needed. Steps of the solution/calculation/process must be clearly shown. Self-written computer programs should include detailed documentation for understanding the procedures and the implementation.

Expectations for AI use: Since large language models (LLMs) are gaining widespread coverage, it is prudent to explain the appropriate use of this technology in academic settings. LLMs have proven incredibly useful in research and teaching by facilitating language analysis, text generation, and more. However, students must use these tools responsibly and ethically. The following will address essential guidelines for acknowledging and reporting the use of LLMs.

Acknowledgement & Transparency: Students must acknowledge and cite using LLMs in their work. Any application of this technology must be reported transparently, including the specific models used and their parameters. Students who use AI tools in writing any document intended for grading and examination, production of images or graphical elements, or data collection and analysis must be transparent in disclosing how and which AI tool was used. Students are fully responsible for the content of their work, even those parts produced by an AI tool, and are thus liable for any breach of publication ethics. Failing to do so may lead to plagiarism, intellectual dishonesty, and the potential for academic misconduct.

Critical Thinking & Analysis: In addition to using LLMs, students should engage in critical thinking and analysis. They must not rely solely on these tools for answers but use them to spark further investigation and thought. It is crucial to evaluate the generated content and question its validity before incorporating it into their work.

Recognizing Limitations: It is essential to recognize the limitations of LLMs. While powerful tools, they are imperfect and have biases, limitations, and assumptions. They also may generate content that is plagiarized. Students must be aware of these limitations when utilizing this technology, check for plagiarism, and take responsibility for the final output. They should always verify the content's accuracy, validity, and appropriateness and any citations generated by language models and correct any errors or inconsistencies.

In summary, while LLMs have the potential to revolutionize research and teaching, graduate and undergraduate students must use these tools responsibly, acknowledging their limitations and biases and combining them with other academic resources to produce the best possible work. Please be aware that the above guidelines may not cover all aspects but offer a foundation for responsible and ethical use. Therefore, students must continuously evaluate their approach and stay informed about the evolving best practices in the field.

Disclaimer: This syllabus is subject to revisions.

Week	Lecture Topic	Assessment
1 Jan 9	Sustainability, Sustainable Development and UN Sustainable Development Goals	Assignment # 1 (Weeks 1-2): Concepts
	Sustainable and Resilient Smart Cities and Their Components	
2 Jan 16	Future Infrastructure Systems (FIS)	
	Humans, Infrastructure, and Technology	
3 Jan 23	Future Energy Systems: Introduction	Assignment # 2 (Weeks 3-4): Energy and Mobility Systems
	Select Topics: Energy-Efficient Buildings and Related Infrastructure	
4 Jan 30	Future Mobility Systems: Introduction	
	Select Topics: Connected/Autonomous Vehicles and Related Infrastructure	
5 Feb 6	Sensing Technologies for FIS: Introduction	Quiz 1: (Weeks 1-4)
	Select Topics: Mobile-Sensing/Crowd-Sensing Systems	Assignment # 3 (Weeks 5-7): Sensing Technologies
6 Feb 13	Data Analytics for FIS: Introduction	
	Select Topics: Digital Filters (1D and/or 2D)	
7 Feb 20	Artificial Intelligence Applications in FIS: Introduction	Midterm Project Reports Due Week 7 (Covering the First ~4 Weeks)
	Select Topics: Computer Vision and AI	
8 Feb 27	Digital Twinning for FIS: Introduction	
	Select Topics: Computer-Vision-based Digital Twins	
9 Mar 6	Building Resilient FIS: Introduction	Quiz 2: (Weeks 5-8)
	Select Topics: System Resiliency	Assignment # 4 (Weeks 8-10): Resiliency and Interdependency
10 Mar 13	Interdependencies of FIS: Introduction	
	Select Topics: Energy-Transportation Infrastructure Interdependency	
11 Mar 20	Adaptation of FIS to Climate Change: Introduction	Assignment # 5 (Weeks 11-12): Climate Change Adaptation
	Select Topics: Impacts of Climate Change on Energy and Transportation Infrastructure Systems	
12 Mar 27	Operation, Management and Decision-making for FIS: Introduction	
	Select Topics: Policies for Future Energy and Transportation Infrastructure Systems	
13 Apr 10	Final Project Presentation	Quiz 3: (Weeks 9-12) Final Project (Comprehensive)