Course Name:

Urban Infrastructure Sustainability Principles

Course Number:

20994

Credit:

3

Pre-requisites:

Engineering Probability

Course Description (Objectives):

This course aims to provide students with the critical knowledge and technical expertise to analyze, plan, and design future urban systems as livable, integrated, and low-carbon entities. More specifically, students should be able to understand what sustainability means and how it can be applied for urban infrastructure systems. .These urban infrastructure systems include: electricity, water, transport, buildings, and solid waste management. Emphasis is put on infrastructure integration and carbon accounting using principles of sustainability and resilience.

Course Content (outline):

- Understand what sustainability means and how it can be applied for engineering projects.
- Understand the role that cities can play in future and use various techniques to forecast population (Short-term/Long-term population forecast techniques).
- Introduce urban infrastructure systems: electricity, water, transport, buildings, and solid waste management with focus on sustainable supply and demand changes.
- Introduce the concept of Urban Metabolism and identify inter-dependencies between each infrastructure system and plan an entire urban environment that is both livable and sustainable.
- Analyze and calculate energy use and greenhouse-gas (GHG) emissions of most urban systems, including electricity, water, transport, buildings, and solid waste management.
- Get familiar with the new *Science of Cities* and the famous laws related to this field.
- Learn new Machine Learning techniques and how to use them in complicated urban problems (e.g., K-means Clustering, Decision Tree Learning, Neural Networks).

References:

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- SIG (2010) Getting to Carbon Neutral: A Guide for Canadian Municipalities, Sustainable Infrastructure Group at University of Toronto, produced for the Toronto and Region Conservation Authority

- Theis, T., and Tomkin, J. (2012) Sustainability: A Comprehensive Foundation, Connexions. Open-source Textbook
- Bauer, K. (2010) City Planning for Civil Engineers, Environmental Engineers, and Surveyors, CRC Press, Taylor and Francis Group, Boca Raton, FL
- MacKay, D. (2009) (2014) Sustainable Energy - Without the Hot Air, UIT, Cambridge, UK, ISBN 978095445293.
- Ascher, K., and Marech, W. (2005) The works: anatomy of a city, Penguin Press, New York, NY
- IPCC (2014) Climate Change 2014: Mitigation of Climate Change, Contribution of Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom
- OECD (2006) Infrastructure to 2030: Telecom, Land Transport, Water and Electricity, Organization for Cooperation and Economic Development Publishing, Paris, France
- Striebig, B., Ogundipe, A., and Papadakis, M. (2015) Engineering Applications in Sustainable Design and Development, Cengage Learning, ISBN-10: 1133629776