

# CESC-Sustainable Smart Cities

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## **CESC 600. Principles of Sustainable Development. 3 Hours.**

The course will begin by discussing the concepts, viewpoints and fundamentals essential for understanding urban sustainable development agenda. This will be followed by the evaluation of international conferences and action items proposed by the scientific / professional community to advance sustainable smart cities development. You will review basic earth sciences to better evaluate the impact our anthropogenic activities have on the natural environment and therefore how to minimize adverse future outcomes. Throughout the course case studies of sustainable developments will be used to illustrate the value, challenges and limitations of this concept. In the end, you will possess the knowledge base needed to help advance sustainable smart cities development.

## **CESC 602. Introduction to Sustainable Smart Cities. 3 Hours.**

This course introduces the issues surrounding sustainable development within cities and explores how the smart city concept can contribute to the urban sustainable development agenda. The course begins by considering the key characteristics of contemporary urbanization and the issues and challenges that these present for sustainability and urban environmental management. The meaning and nature of sustainability for cities will be discussed, followed by a consideration of the definitions of a smart city and a discussion of the key elements of a smart city including its contribution to both urban governance and the more effective and efficient management of natural resources. With reference to case studies the final part of the course will explore and evaluate the role that smart city processes and applications can play in enhancing the social, economic and environmental aspects of sustainable development within urban areas.

## **CESC 604. Low-Carbon and Renewable Energy Systems for Smart Cities. 3 Hours.**

As the energy infrastructure is arguably the most important feature in any city energy efficiency and integration of renewable energy sources within urban areas are central to the smart city concept. This course will firstly explore why there is a need for the greater use of low carbon and renewable energy systems within cities, followed by an introduction to the range of low carbon and renewable energy technologies currently available. The course will then move on to introduce the concept of the smart grid and then explore the potential to integrate low carbon and renewable energy systems into smart grids in order to move towards cost-effective, efficient and more environmentally friendly energy provision within cities. Challenges and issues associated with the greater integration of low carbon and renewable energy systems into energy infrastructure within large urban areas will also be considered.

## **CESC 606. Managing Natural Resources and Sustainable Smart Cities. 3 Hours.**

The course examines the challenges of resource use and management within the context of an urbanizing world, exploring how new concepts within the smart and sustainable city agenda may contribute to addressing these challenges. The course begins by considering contemporary patterns of resource use created by cities in the modern world at a variety of scales from the local to the global. New approaches in the form of ecosystem services and urban metabolism in relation to natural resource management are examined in terms of their contribution to developing a smart and sustainable city agenda. The course continues by exploring a selection of key natural resources challenges (e.g. water, energy, air quality and climate) and the development of new management approaches and strategies in these areas. The course concludes by examining the development of integrated environmental management systems and governance structures within which these new approaches can be implemented with reference to a series of case studies.

## **CESC 608. Green Infrastructure and Transportation. 3 Hours.**

The course covers policy and technical issues related to sustainable transportation. The course begins by discussing the concepts, viewpoints and fundamentals essential for understanding sustainable transportation planning. Tools used to assess sustainability of transportation facilities and neighborhoods are introduced next. The course also presents design options in support of green infrastructure and transportation, including livable street design, and traffic calming applications. The course is expected to expand students' knowledge base on sustainable transportation issues and help them understand the concept of sustainable transportation toward the development of sustainable smart cities.

## **CESC 610. Health and Liveability. 3 Hours.**

This course will address the multidisciplinary aspects of urban environmental quality and its impact on human well-being. It will provide a critical appreciation of the factors which influence health, well-being and quality of life within contemporary urban environments, demonstrate the importance of genomics and health informatics in developing strategies for improving the health and well-being of urban citizens, explore the importance of urban design and the contribution of the development of food smart cities in improving both urban health and liveability, and understand the increasingly important role of Information and Communications Technology (ICT) in facilitating delivery of effective and responsive urban health, well-being, and quality of life strategies.

## **CESC 612. Green Buildings. 3 Hours.**

The course will begin by discussing the concepts, viewpoints and fundamentals essential for understanding green building and construction. Discussions will then be focused on how key stakeholders and their future collaborations can begin to incorporate sustainable construction practices for the betterment of the project (new construction and inventory rehabilitation). This will be followed by the evaluation of sustainable construction rating systems (LEED, BREEAM, etc.) and how they can be applied to occupied buildings throughout an urban environment. Modular case studies of sustainable construction projects (individual structures to entire community developments) will be used to illustrate the value, challenges and limitations of this concept. In the end, students will possess an expanded knowledge base needed to help advance sustainable smart cities development.

**CESC 614. Smart Cities Technologies. 3 Hours.**

This course gives students the opportunity to study emerging smart technologies that can be deployed and integrated together with the aim of improving overall building / city performance. The course provides an overview of technologies that can be used to: sense and measure physical parameters; acquire, process, and analyze various datasets; and make appropriate decisions / gives suitable instructions based on all available information. Specific technologies addressed include Data Acquisition, Telecommunications, Wireless Sensor Networks, and the Internet of Things. The course will also explore and evaluate how these emerging technologies can contribute to various smart cities / buildings priorities, namely Energy Management, Health, Safety, and Security.

**CESC 616. Big Data and Smart Cities. 3 Hours.**

The world is becoming increasingly digitally interconnected and this instrumentation, data collection, interconnection, storage, and analysis can provide the capacity to radically transform how cities monitor, manage and enhance their environmental quality and livability. This course will provide an introduction to what big data is and how it can contribute to the smarter, more sustainable management of cities. The course will begin by discussing the concepts of big data and the big data revolution, and an overview of the ways in which data can be captured, stored and analyzed. This will be followed by a consideration of how big data can be used by city managers to optimize: their use of physical and digital infrastructures; their sustainable use of natural resources; citizen service delivery; and citizen engagement, participation and urban governance. You will also be introduced to some of the challenges presented by big data, both the technological challenges and the ethical and social implications associated with collecting, storing and using big data. Throughout the course case studies of big data in action will be used to illustrate the value, challenges and limitations of big data in the smarter, more sustainable management of cities.

**CESC 618. Research Methods and Project Planning. 3 Hours.**

As a student of smart city processes and urban environmental management you need to understand the research process which enables you to take the knowledge and skills which you have learned and apply it to a specific urban sustainability / environmental management issue. This course is not intended to provide a training in research techniques, but rather to make you aware of a wide range of investigative and analytical methods and techniques using examples drawn from the areas of smart city approaches, urban sustainability and environmental management. Both quantitative and qualitative methodologies and primary and secondary data collection will be covered. You will be encouraged to reflect on the research process and its outcomes by critiquing research papers written from methodological standpoints. You will then apply this knowledge to create a viable research proposal for your own Sustainable Smart Cities Masters project. This proposal will require you to identify and justify for your chosen topic: (i) appropriate research questions, (ii) methodologies and data sampling / collection techniques, (iii) ethical and health and safety implications and, (iv) a timetable of action.

**CESC 620. Sustainable Smart Cities Research Project. 0 Hours.**

This course will develop skills in both research and technical writing in the area of applying and/or evaluating sustainable smart cities processes and policies to a specific urban environmental or sustainability issue. The research proposal produced as part of the Research Methods and Project Planning course will be implemented. This will involve further research into the relevant background and context of a chosen project topic, implementation and evaluation of appropriate methods for collecting and analyzing data, observations and information, the ability to present findings clearly and concisely, and appreciate their significance in relation to the smart city and sustainable urban management agendas. Research should be at the forefront of student's chosen sustainable smart cities research topic and be at a level similar to that required for acceptance and presentation at a national level conference or symposium on smart and sustainable cities. For students in relevant employment, projects may be carried out in your place of work subject to discussions between you, your employer/line manager, and your project supervisor.