SEE4205: DESIGN OF SMART CITIES AND SUSTAINABLE BUILDING

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Design of Smart Cities and Sustainable Building

Subject Code
SEE - School of Energy and Environment
Course Number
4205

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to provide the students with the knowledge and principles needed for the successful design of sustainable and energy efficient buildings and smart and sustainable cities. The course introduces environmental design and engineering principles applied to the built environment.

Students will learn the fundamentals of passive and active design in response to site conditions. The adaptation of the built environment to future warmer climate conditions to minimise the effects of Urban Heat Island Effects is explored. Issues such as Walled Effects and planning for ventilation availability will be explored. The renovation and refurbishment of existing buildings and precincts to reduce CO_2 emissions are explored.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain the principles of sustainable design principles and context.		x		
2	Explain the design considerations and local and global constraints including social, regulatory, technical and environmental constraints.		x		
3	Generate sustainable design at building, district and city level.		x	x	x
4	Describe global implications of sustainable built environment.		x	x	
5	Apply the principles of sustainable design in response to specific site conditions while complying with planning parameters and client' s requirements.		x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Students will engage in lectures with facilitated discussion to explain key theories and concepts of sustainable design.	1, 2, 3, 4, 5	2
2	Tutorial	Students will learn through case studies and example data sets and be able to apply it for smart city design.	1, 2, 3, 4, 5	1

3	Analysis	Students will engage in the activities to analyse data sets and examples to demonstrate critical thinking and interpretation of the empirical evidence of the environmental performance of the built environment.	1, 2, 3, 4, 5	3

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Task 1: The students will learn data research and analyse the influence/ impact of climatic conditions on building design.	1, 2, 3	20	
2	Task 2: The students will learn data representation and existing building energy use analysis to assist communication of sustainable design.	2, 3, 4	20	
3	Individual Assignment The students will research zero or low carbon building/ community/city and write a critical paper.	1, 2, 3, 4, 5	20	
4	Group Assignment The students will adapt the design of a typical office tower in two different climatic zones in response to site conditions and planning parameters.	1, 2, 3, 4, 5	40	

Continuous Assessment (%)

100

Examination (%)

0

Examination Duration (Hours)

N/A

Additional Information for ATs

Examination duration: N/A
Percentage of continuous assessment, examination, etc.: 100% by continuous assessment

To pass a course, a student must do ALL of the following:
1) obtain at least 30% of the total marks allocated towards continuous assessment (combination of assignments, pop quizzes, term paper, lab reports and/or quiz, if applicable);
2) obtain at least 30% of the total marks allocated towards final examination (if applicable); and
3) meet the criteria listed in the section on Assessment Rubrics.

Assessment Rubrics (AR)

Assessment Task
1. Task 1 - climatic data

The students will learn data research and analyse the influence/impact of climatic conditions on building design.

Criterion
Search appropriate sources from different sources and use of data to inform design process.

Analyse buildings to understand how climatic conditions can be incorporated into building design.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Assessment Task
2. Task 2 – sankey diagram

The students will learn data representation and existing building energy use analysis to assist communication of sustainable design.

Criterion
Utilise end use energy data from EMSD and learn and analyse current building stock’ s energy use patterns.

Use appropriate graphical representations and/or infographics to communicate sustainable design.

Understand typical building energy use and differences between typical uses such as residential, office and retail.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)

Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Assessment Task
3. Individual Assignment

The students will research zero or low carbon building/community/city and write a critical paper.

Criterion
Analyse different precedents of zero carbon building/community/city with their success/failure and why.

Learn the difference between design data and actual operation data, hence learning the challenge of behavioural change.

Highlight unique sustainable features of the chosen projects and how they work.

Prepare ‘posters’ to communicate project’s intent, design, operation data and lessons learned.

Present in a short ‘sales pitch’ to present own projects with key points.

Understand different definitions of low, zero carbon, energy, operational energy projects with the concept of offsite offsets.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Assessment Task
4. Group Assignment

The students will adapt the design of a typical office tower in two different climatic zones in response to site conditions and planning parameters.

Criterion
Understand how to develop and incorporate sustainable design while complying with planning parameters.

Use building energy data and establish sustainable design strategy to ensure energy-efficient building.

Understand the importance of clean energy sources, hence carbon emissions from electricity.

Devise strategies to reduce environmental impact of a building from different players' point of view.

Student report will provide an overview of the design aims and concepts and understanding of sustainable design principles.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Part III Other Information

Keyword Syllabus
Sustainable Building, Energy Efficiency in the Built Environment, Smart City, Passive Design Green House Gas Emissions, Building Rating Systems.

Reading List

Compulsory Readings

	Title
1	Introduction to Building Physics. Carl-Eric Hagentoft Published by Studentlitteratur AB, 2001
2	DeKay, M. and Brown, G.Z., 2013. Sun, wind, and light: Architectural design strategies. John Wiley & Sons.
3	Mackay, D., Sustainable Energy – Without Hot Air, http://www.withouthotair.com/

Additional Readings

	Title
1	A Handbook of Sustainable Building Design and Engineering: An Integrated Approach to Energy, Health and Operational Performance (BEST (Buildings Energy and Solar Technology)) Hardcover – January 30, 2009 by Dejan Mumovic (Editor), Mat Santamouris (Editor)
2	Counteracting Urban Heat Island Effects in a Global Climate Change Scenario. Editors: Musco, Francesco