CA5252: BUILDING ENVIRONMENT MODELLING FOR SUSTAINABILITY ANALYSIS

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Building Environment Modelling for Sustainability Analysis

Subject Code
CA - Civil and Architectural Engineering
Course Number
5252

Academic Unit
Architecture and Civil Engineering (CA)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

The course aims to provide students with an overview of the popular building energy modelling tools; an understanding of the underlying principles in modelling building energy systems; and an ability of application for system design and facilities management.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the features and capabilities of common tools for building energy modelling.		x		
2	Discuss the principles, mechanisms, assumptions and limitations in modelling the typical building energy systems, such as HVAC and lighting.		x	x	
3	Discuss the principles, mechanisms, assumptions and limitations in modelling the advanced building energy systems, such as trigeneration and renewable energy systems.		x	x	
4	Apply building energy modelling for system design, energy management and retro-commissioning.			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	Lectures; seminars	Introduce and discuss the principles of common tools for building energy modelling of various building energy systems according to engineering practice and development.	1, 2, 3, 4	2
2	Tutorials; site visits	Discuss and apply the skills of building energy modelling of various building energy systems for system design, energy management and retro-commissioning.	2, 3, 4	1

Additional Information for LTAs

Semester Hours: 3 hours per week
Lecture/Tutorial/Laboratory Mix: Lecture (2); Tutorial (1); Laboratory (0)

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Mid-term test	1, 2	25	
2	Assignment	2, 3, 4	25	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

To pass a course, a student must obtain minimum marks of 30% in both coursework and examination components, and an overall mark of at least 40%

Assessment Rubrics (AR)

Assessment Task

Mid-term test (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

1. ABILITY to RECOGNIZE and EXPLAIN the key principles, mechanisms, assumptions and limitations of building energy modelling tools.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Assignment (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

1. CAPACITY to INQUIRE and ANALYSE the issues and relevant information and references with respect to given scenarios and context.

2. ABILITY to
PRODUCE and ARTICULATE rational, substantiated and original discussion and/or suggestion.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
1. ABILITY to EXPLAIN and DISCUSS the key principles, mechanisms, assumptions and limitations of building energy modelling tools for system design and facilities management.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Mid-term test (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
1. ABILITY to RECOGNIZE and EXPLAIN the key principles, mechanisms, assumptions and limitations of building energy modelling tools.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Assignment (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
1. CAPACITY to INQUIRE and ANALYSE the issues and relevant information and references with respect to given scenarios and context.
2. ABILITY to
PRODUCE and ARTICULATE rational, substantiated and original discussion and/or suggestion.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

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(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
1. ABILITY to EXPLAIN and DISCUSS the key principles, mechanisms, assumptions and limitations of building energy modelling tools for system design and facilities management.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic

Failure
(F) Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

Thermal load solution method. Cooling and heating system simulation. Illuminance and lighting modelling. Modelling of advanced energy systems. Renewable energy system modelling. Application in system design and facilities management.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Code of Practice for Energy Efficiency of Building Services Installation, Electrical and Mechanical Services Department, Hong Kong SAR Government, 2021 (or latest edition).
2	Code of Practice for Building Energy Audit, Electrical and Mechanical Services Department, Hong Kong SAR Government, 2021 (or latest edition).
3	Technical Guidelines on Retro-commissioning, Electrical and Mechanical Services Department, Hong Kong SAR Government, 2018 (or latest edition).
4	ASHRAE Handbook – Fundamentals 2021 (or latest edition)
5	ASHRAE Handbook – HVAC Systems and Equipment 2020 (or latest edition)
6	ASHRAE Handbook – Applications 2019 (or latest edition)
7	EnergyPlus. https://energyplus.net/
8	eQuest. https://www.doe2.com/equest/
9	Design Builder. https://designbuilder.co.uk/
10	TRNSYS. http://www.trnsys.com/
11	COMSOL. https://www.comsol.com/
12	DIALux. https://www.dial.de/en/dialux/