CA3565: SMART BUILDING AND INFRASTRUCTURE

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Smart Building and Infrastructure

Subject Code

CA - Civil and Architectural Engineering

Course Number

3565

Academic Unit

Architecture and Civil Engineering (CA)

College/School

College of Engineering (EG)

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

Climate change, manmade disruptions and pandemic will continue to affect the society for the years to come. To cope with all these challenges, there is a need to rethink about how to make building and infrastructure facilities more adaptable to various types of threats in future. Advance in smart technologies may open up new ways to improve the reliability, efficiency and resilience of built facilities and hence the wellbeing of the society. In this course, the evolvement of smart building and infrastructure facilities will first be introduced. It will then be followed by the discussion of a series of smart technologies being applied in the building and infrastructure sectors. The basic concept of digital twin and deep learning will then be elaborated. Finally, case studies be used to showcase some successful smart building and infrastructure facilities around the world.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe key concepts in smart building and infrastructure facilities			x	
2	Explain and discuss smart technologies being applied in building and infrastructure sectors		x		
3	Explain digital twin and apply deep learning.			x	
4	Discuss the applicability of smart technologies in practice.				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 formal lectures to obtain knowledge related to smart building and infrastructure.	1, 2, 3, 4	2
2	Tutorial	Students will participate in class discussions and activities on problems related to lecture themes to improve their knowledge and their use of tools.	1, 2, 3, 4	1

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Mid-term Test	1, 2, 3, 4	25	
2	Coursework	1, 2, 3, 4	45	

Continuous Assessment (%)

70

Examination (%)

30

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

Criterion

ABILITY to UNDERSTAND and APPLY the key concepts and knowledge to topics related to smart building and infrastructure.

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

Coursework

Criterion

CAPACITY to EXPLORE, INVESTIGATE, and ORGANIZE knowledge and ideas in an independent fashion in various topics of smart building and infrastructure.

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

Criterion

ABILITY to EXPLAIN and DISCUSS the key concepts and knowledge to topics related to smart building and infrastructure.

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

Part III Other Information

Keyword Syllabus

Functionality of built facilities, Smart transformation, Intelligent building, Smart infrastructure, Internet of things, Computer vision, Building information modelling, Geographic information system, Digital twin, Deep learning.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Nath, S.V. and van Schalkwyk, P., Building Industrial Digital Twins: Design, develop, and deploy digital twin solutions for real-world industries using Azure Digital Twins, https://ieeexplore.ieee.org/document/10163600
2	Sinopoli, J., Smart Buildings
3	Sinopoli, J., Advanced Technology for Smart Buildings, ISBN: 9781608078653

| 4 | Sanjeevikumar, P., Gnana Swathika, O.V. & Karthikeyan, K., Smart Buildings Digitalization: IoT and Energy Efficient Smart Buildings Architecture and Applications ISBN : 9781003201069 (ebk) |
| 5 | Mehmood, R., Katib, I., Chlamtac, I. & See, S., Smart Infrastructure and Applications: Foundations for Smarter Cities and Societies, https://link.springer.com/book/10.1007/978-3-030-13705-2 |