

CA3171: INNOVATIONS IN CONSTRUCTION TECHNOLOGY

Effective Term

Semester B 2022/23

Part I Course Overview

Course Title

Innovations in Construction Technology

Subject Code

CA - Civil and Architectural Engineering

Course Number

3171

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

CA3618 Construction Technology / CA3703 Construction Methods and Equipment

Part II Course Details

Abstract

The course fosters students' understanding of the relationship between architecture and construction through the study of recent developments in materials, design and construction technologies. An overview of the assembly/construction principles using conventional building materials and the construction methods for various types of structural elements, interior components, and site work will be provided. Contemporary advances in materials, design and construction techniques such as the issues pertinent to emergent materials, environmental concerns, sustainable design, digital manufacturing, digital fabrication, smart construction materials and technology, and the applications of 3D-printing, virtual and augmented reality techniques in construction will also be presented. The course stimulates students to reflect on the relationship between architecture and construction and how architecture differs from mere construction.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 DEC-A2 DEC-A3 app.)			
1	Depict the assembly/construction principles for common building materials (e.g., concrete, masonry, steel and timber) and how it affects the decision-making in architectural design;			x	
2	Describe the construction methods of various types of structural elements, interior components, and site work;			x	
3	Enumerate the emerging issues in contemporary building construction and explain how to address the issues in architectural design;		x	x	
4	Illustrate the advancements in digital techniques and potential applications and/or integration of the techniques in architecture and construction.		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.

Teaching and Learning Activities (TLAs)

TLAs		Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Oral presentations delivered by the instructors covering various subjects related to material choices, construction methods, emerging issues, new technology, and pertinent architectural design considerations	1, 2, 3, 4	
2	Tutorial, laboratory demonstration, and site visit	Case studies; demonstration of the digital techniques and construction technology in the laboratory or at actual construction sites	2, 3, 4	

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Mid-term Test	1, 2, 3	10	
2	Assignments	1, 2, 3, 4	80	

Continuous Assessment (%)

90

Examination (%)

10

Examination Duration (Hours)

1.5

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

- 1.1 Demonstrate understandings in the assembly/construction principles for common building materials (e.g., concrete, masonry, steel and timber) and how it affects the decision-making in architectural design.
- 1.2 Ability to explain the construction methods of various types of structural elements, interior components, and site work;
- 1.3 Ability to enumerate the emerging issues in contemporary building construction and explain how to address the issues in architectural 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 levels

Assessment Task

Assignments

Criterion

- 2.1 Demonstrate understandings in the assembly/construction principles for common building materials (e.g., concrete, masonry, steel and timber) and how it affects the decision-making in architectural design.
- 2.2 Ability to explain the construction methods of various types of structural elements, interior components, and site work;
- 2.3 Ability to enumerate the emerging issues in contemporary building construction and explain how to address the issues in architectural design.
- 2.4 Ability to illustrate the advancements in digital techniques and potential applications and/or integration of the techniques in architecture and construction.

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

- 3.1 Demonstrate understandings in the assembly/construction principles for common building materials (e.g., concrete, masonry, steel and timber) and how it affects the decision-making in architectural design.
- 3.2 Ability to explain the construction methods of various types of structural elements, interior components, and site work;
- 3.3 Ability to enumerate the emerging issues in contemporary building construction and explain how to address the issues in architectural 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 levels

Part III Other Information

Keyword Syllabus

- Building materials (concrete, masonry, steel, and timber); Construction methods (foundations, beams and columns, slabs and walls, roofs, stairs, openings, façade systems, and connections/joints); Interior components (flooring and ceiling systems, furnishing and equipment); Site works (external and landscape works);
- Modularity; Prefabrication; Environmental concerns and challenges; New materials; Introduction to sustainable design;
- Recent development of digital technologies (digital architecture, digital manufacturing, and digital fabrication); Smart construction; 3D-printing; Virtual reality and augmented reality.

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

Title	
1	Snyder V. Refabricating Architecture: How Manufacturing Methodologies are Poised to Transform Building Construction[J]. 2005.
2	Caneparo L, Cerrato A. Digital fabrication in architecture, engineering and construction[M]. Springer Netherlands, 2014.
3	Williams K. Digital Fabrication[M]//Digital Fabrication. Birkhäuser, Basel, 2012: 407-408.
4	Iwamoto L. Digital fabrications: architectural and material techniques[M]. Princeton Architectural Press, 2013.
5	Frazer J. An evolutionary architecture[J]. 1995.
6	Dunn N. Digital fabrication in architecture[M]. Laurence King Publishing, 2012.
7	Mazzoleni I. Architecture follows nature-biomimetic principles for innovative design[M]. Crc Press, 2013.
8	Pohl G, Nachtigall W. Biomimetics for Architecture & Design: Nature-Analogies-Technology[M]. Springer, 2015.
9	Terzidis K. Algorithmic architecture[M]. Routledge, 2006.
10	Architectural Design 0403 emergences
11	Architectural Design 0602 Mophogenetic Design
12	Stenson M W. Architectural intelligence: How designers and architects created the digital landscape[M]. mit Press, 2022.
13	Leach N. Design in THE age of artificial intelligence[J]. Landscape Architecture Frontiers, 2018, 6(2): 8-20.
14	Picon A. Digital culture in architecture[M]//Digital Culture in Architecture. Birkhäuser, 2010.

15	Agkathidis A. Generative design[M]. Hachette UK, 2016.
16	Negroponte N. Soft architecture machines[M]. Cambridge, MA: MIT press, 1975.
17	Carpo M. The alphabet and the algorithm[M]. Mit Press, 2011.
18	Negroponte N. The architecture machine[J]. Computer-Aided Design, 1975, 7(3): 190-195.
19	The digital turn in architecture 1992-2012[M]. John Wiley & Sons, 2012.
20	Carpo M. The second digital turn: design beyond intelligence[M]. MIT press, 2017.