CA6701: ADVANCED TOPICS IN COMPUTATIONAL DESIGN

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Advanced Topics in Computational Design

Subject Code
CA - Civil and Architectural Engineering
Course Number
6701

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

This course aims to provide students with advanced knowledge of computational design in architecture. In this course, students are expected to examine computational and parametric design by using programming language. Surveying theoretical, methodological and technical knowledge of computational and parametric design, in particular, this course organization focuses on implementing advanced technology of scripting and programming for creating a new form-creating in architecture. Students are expected to innovatively and creatively propose new, advanced methods of architectural design by establishing their own design logic.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Identify theoretical, methodological and technical foundation of computation design and programming language		x	x	
2	Examine computational design and its application			x	
3	Create innovative forms by using parametric design, scripting, and programming			x	x
4	Justify and apply new, advanced design logics of form-creating in architecture		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 activities about computational design in Architecture	1, 2, 3	
2	Laboratory	Students will engage in tutorials with in-class activities on computational design	3, 4	

Additional Information for LTAs

Semester Hours: 3 hours per week

Lecture/Tutorial/Laboratory Mix: Lecture (Mix); Tutorial (-); Laboratory (Mix)

3 hrs per week including lectures and laboratory sessions

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignments	1, 2, 3, 4	100	-	Yes

Continuous Assessment (%)

100

Minimum Continuous Assessment Passing Requirement (%)

40

Assessment Rubrics (AR)

Assessment Task

Assignments (Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

ABILITY to UNDERSTAND, ANALYZE, and DISCUSS topics related to computational design in architecture and design;
CREATE innovative forms by using parametric design, scripting, and programming;
CREATE new, advanced design logics of form-creating in architecture.

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

Criterion

ABILITY to UNDERSTAND, ANALYZE, and DISCUSS topics related to computational design in architecture and design;
CREATE innovative forms by using parametric design, scripting, and programming;
CREATE new, advanced design logics of form-creating in architecture.

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

Scripting, Programming, Parametric Design, Artificial Intelligence, Python, Grasshopper, Rhino.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Reas, C. & McWilliams, C. (2010) Form+Code in Design, Art and Architecture. New York: Princeton Architectural Press.
2	Lars Spuybroek, L. (2004) NOX: Machining Architecture. New York, N.Y.: Thames and Hudson.
3	Burry, M. (2001) Scripting Cultures: architectural design and programming. London: Wiley.
4	Meredith, M. et al (eds.) (2008) From Control to Design: Parametric/Algorithmic Architecture. Barcelona: Actar.
5	Weinstock, M. (2010) The Architecture of Emergence. London, Wiley.
6	Caneparo L, Cerrato A. Digital fabrication in architecture, engineering and construction[M]. Springer Netherlands, 2014.
7	Snyder V. Refabricating Architecture: How Manufacturing Methodologies are Poised to Transform Building Construction[J]. 2005.
8	Williams K. Digital Fabrication[M]//Digital Fabrication. Birkhäuser, Basel, 2012: 407-408.
9	Iwamoto L. Digital fabrications: architectural and material techniques[M]. Princeton Architectural Press, 2013.
10	Frazer J. An evolutionary architecture[J]. 1995.
11	Dunn N. Digital fabrication in architecture[M]. Laurence King Publishing, 2012.
12	Mazzoleni I. Architecture follows nature-biomimetic principles for innovative design[M]. Crc Press, 2013.
13	Pohl G, Nachtigall W. Biomimetics for Architecture & Design: Nature-Analogies-Technology[M]. Springer, 2015.
14	Terzidis K. Algorithmic architecture[M]. Routledge, 2006.
15	Architectural Design 0403 emergences
16	Architectural Design 0602 Mophogenetic Design
17	Steenson M W. Architectural intelligence: How designers and architects created the digital landscape[M]. mit Press, 2022.
18	Leach N. Design in THE age of artificial intelligence[J]. Landscape Architecture Frontiers, 2018, 6(2): 8-20.
19	Picon A. Digital culture in architecture[M]//Digital Culture in Architecture. Birkhäuser, 2010.
20	Agkathidis A. Generative design[M]. Hachette UK, 2016.
21	Negroponte N. Soft architecture machines[M]. Cambridge, MA: MIT press, 1975.
22	Carpo M. The alphabet and the algorithm[M]. Mit Press, 2011.
23	Negroponte N. The architecture machine[J]. Computer-Aided Design, 1975, 7(3): 190-195.
24	The digital turn in architecture 1992-2012[M]. John Wiley & Sons, 2012.
25	Carpo M. The second digital turn: design beyond intelligence[M]. MIT press, 2017.