

CA3200: ADVANCED DESIGN TOOLS

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Advanced Design Tools

Subject Code

CA - Civil and Architectural Engineering

Course Number

3200

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

This course provides students with knowledge of advanced computer-aided design techniques to assist in the design; preparation; communication and sharing of building design information, and equips them with the necessary skills for using various software programs to carry out these tasks efficiently and effectively.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Apply advanced computer-aided design techniques in the design process, preparation, communication and production of architectural design proposals;		x	x	
2	Use computer-aided design techniques to generate multiple alternative architectural design proposals demonstrating similar design concepts and/or aesthetic perception, and enumerate proper criteria for evaluating the design alternatives;		x	x	
3	Explain how the emerging design theories and/or methods (such as digital architecture and parametric design) differ from the conventional architecture and design philosophy;		x		
4	Adopt emerging design theories and/or methods in preparation of architectural design proposals.		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	Demonstration	Students will explain and exercise the principles, theories, software and techniques of advanced computer aided design.	1, 2, 3, 4	
2	Hands-on	Students will apply advanced computer aided design techniques on a given scenario; and will create advanced computer aided design models and representations.	1, 2, 4	

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2, 3	35	
2	In-class Assessment	1, 2	25	
3	Project	1, 2, 3, 4	40	

Continuous Assessment (%)

100

Examination (%)

0

Assessment Rubrics (AR)**Assessment Task**

Assignments

Criterion

1.1 CAPACITY to DISCUSS the key procedures in applying advanced computer aided design techniques.

1.2 ABILITY to USE the scientific techniques in solving advanced design challenges.

1.3 ABILITY to APPLY suitable advanced computer aided design techniques on a given scenario.

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

In-class Assessment

Criterion

2.1 ABILITY to USE the scientific techniques in solving advanced design challenges.

2.2 ABILITY to APPLY suitable advanced computer aided design techniques on a given scenario.

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

Project

Criterion

3.1 ABILITY to ANALYZE and PARAMETERIZE an abstract design concept so as to IMPLEMENT and VISUALIZE the concept as architectural forms, adopting advanced form-finding and form-generating techniques.

3.2 CAPACITY to OPERATE advanced computer aided design programs to explore various alternatives of innovative architectural forms.

3.3 ABILITY to APPLY the advanced computer aided design techniques in solving future architectural design challenges.

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**

Object-based computer-aided design; Digital architecture; Algorithm-aided design; Visual programming; Form-finding techniques; Design alternative evaluation; Parametric modelling; NURBS curves and surfaces; Data types; Data structure; Data generation; Data manipulation; Data matching; Conditional test; Judgement; Recursion; Penalization; Mesh and Smoothen; Algebra-based transformation; Proximity-based transformation; Force-based transformation; Change base transformation; 3D-printable models; or BIM: Creating and programming automated routines. Advanced drawing organization and management. Data sharing and file interlink. Computer-aided design networking. Document sharing on the internet. Customized menus and commands for special tasks.

Reading List**Compulsory Readings**

Title	
1	Nil

Additional Readings

Title	
1	Kim, Eddy Man, and Rhee, Jinmo, (2019), Digital Media Series: Rhinoceros, Independently Published, 202 p.p., ISBN-10: 1798011352, ISBN-13: 978-1798011355.
2	Robert McNeel & Associates (2020), RHINO 6 USERS GUIDE, http://docs.mcneel.com/rhino/6/usersguide/en-us/index.htm
3	Szalapaj, P., (2001), CAD Principles for Architectural Design: An Analytical Approach to the Computational Representation of Architectural Form, Oxford : Architectural Press.
4	Tedeschi, Arturo, (2014), AAD Algorithms-Aided Design: Parametric Strategies using Grasshopper, Le Penseur, 496 p.p., ISBN-10: 8895315308, ISBN-13: 978-8895315300
5	Von Wodtke, M., (2000), Design with digital tools : using new media creatively, New York ; London : McGraw-Hill.