CA4708: FINITE ELEMENT METHODS IN CIVIL ENGINEERING

Effective Term
Semester B 2025/26

Part I Course Overview

Course Title
Finite Element Methods in Civil Engineering

Subject Code
CA - Civil and Architectural Engineering
Course Number
4708

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
CA3633 Structural Analysis

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

The ability for Civil or Structural Engineers to carry out analysis of complicated structural system (e.g., buildings and bridges) is essential. Nowadays, finite element analysis is the most popular method for calculating the displacement and so as the internal member forces (i.e., axial force, shear force and bending moment) of structural members for the purpose of ultimate limit state and serviceability limit state design. The main objective of this course is to extend the students' ability in structural analysis from manual calculation to computer-aided analysis by finite element methods and other numerical methods, and equipment them for working as a practical engineer or doing structural and civil related research works.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe and identify the appropriate formulas for solving engineering differential equations using numerical methods with aid of computer software;	30		x	
2	Evaluate and formulate appropriate one or two dimensional finite element models for civil or other engineering problems;	30	x	x	
3	Design and carry out structural analysis using finite element software applications.	40		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 to gain the knowledge about the principles and formulations	1, 2, 3	2 hrs/week
2	Tutorial	Students will engage in tutorials to extend their use of knowledge during discussions on tutorial questions	1, 2	1 hr/week for 9 weeks
3	In-class hands-on	Allowing students to use finite element applications for solving civil engineering problems	3	1 hr/week for 4 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Test 1	1, 2, 3	20		No
2	Test 2	1, 2, 3	20		No
3	One assignment	1, 2, 3	10		No

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

3

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

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

Test 1

Criterion

ABILITY to APPLY the formulations and methods introduced in solving structural analysis problems.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal level

Assessment Task

Test 2

Criterion

ABILITY to APPLY the formulations and methods introduced in solving structural analysis problems.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Assessment Task
Individual assignment

Criterion
ABILITY to MASTER commercial finite element applications in solving civil engineering problems.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Assessment Task
Examination

Criterion
ABILITY to APPLY the formulations and methods introduced in solving structural analysis problems.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal level

Part III Other Information

Keyword Syllabus

Finite element formulation; weighted residual method, Galerkin method, variational principle numerical method; finite element analysis and its applications to engineering differential problems; the use of computer applications in finite element analysis and design.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Friedel Hartmann and Casimir Katz, Structural analysis with finite elements, 2nd Edition, Springe.
2	Wail N. Al-Rifaie and Ashok K. Govil, Finite Element Methods - For Structural Engineers, New Age International (P) Limited, Publishers.
3	Reddy J. N. 1984, An introduction to the finite element method, New York: McGraw-Hill, c1984.
4	ANSYS Inc. PDF Documentation for Release 15.0 (http://148.204.81.206/Ansys/readme.html)