

CA8026: PLASTICITY

Effective Term

Semester B 2024/25

Part I Course Overview

Course Title

Plasticity

Subject Code

CA - Civil and Architectural Engineering

Course Number

8026

Academic Unit

Architecture and Civil Engineering (CA)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

R8 - Research Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Additional Information

Some courses offered in Summer Term may start a few weeks earlier than the normal University schedule. Please check the teaching schedules with CLs before registering for the courses.

Part II Course Details

Abstract

The course intends to provide students with knowledge on mathematical formulation of the constitutive laws of plasticity; yield criteria and their experimental verification; plastic stress-strain relations and their associated flow rules; correspondence between rate-independent and rate-dependent plasticity; solutions to basic boundary-value problems, including plane problems and those involving cylindrical and spherical symmetries; variational and minimum principles; limit analysis; plane-strain problems and crystal plasticity; finite-strain theory.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	learn and discover fundamental principles of plasticity to analyze and design structural members under axial load, shear load, bending moment and torsional moment	25	x		
2	model and analyze the plastic behavior of structural components subjected to various loading	25		x	
3	discover appropriate approximation to solve plastic boundary-value problems of structures	25		x	
4	discover the advanced topics in plastic mechanics, variation principles, and nonlinear analysis of plates and shells	25		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	Address the basic principles and theories for Plastic Mechanics	1, 2, 3, 4	2 hours/week
2	Tutorial	Explain how to get the solutions of plastic rods, beams and plates	1, 2, 3, 4	1 hour/week

Additional Information for LTAs

Semester Hours: 3 hours per week

Lecture/Tutorial/Laboratory Mix: Lecture (2); Tutorial (1); Laboratory (0)

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignment	1, 2, 3, 4	30	
2	Mid-term test	2	20	

Continuous Assessment (%)

50

Examination (%)

50

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**

Assignment (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

ABILITY to Use plasticity to do extreme design of rods and beams in structural engineering

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

Mid-term test (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

ABILITY to APPLY the basic principle and the scientific techniques in solving the plastic rods, beams and plates

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

Criterion

CAPACITY to UNDERSTAND the mathematical theories and USE them in solving an engineering problem

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

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

Criterion

ABILITY to Use plasticity to do extreme design of rods and beams in structural engineering

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Mid-term test (for students admitted from Semester A 2022/23 to Summer Term 2024)

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Assessment Task

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CAPACITY to UNDERSTAND the mathematical theories and USE them in solving an engineering problem

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Part III Other Information

Keyword Syllabus

Phenomenological and mathematical formulation of the constitutive laws of plasticity; yield criteria and their experimental verification; plastic stress-strain relations and their associated flow rules; correspondence between rate-independent and rate-dependent plasticity; solutions to basic boundary-value problems, including plane problems and those involving cylindrical and spherical symmetries; variational and minimum principles; limit analysis; plane-strain problems and crystal plasticity; finite-strain theory.

Reading List**Compulsory Readings**

Title	
1	Han, WM & Reddy, BD 2013, Plasticity: mathematical theory and numerical analysis, 2nd edn Springer, New York.
2	Salençon J 2013, Yield design, ISTE Ltd, London.

Additional Readings

Title	
1	Shabana AA 2012, Computational continuum mechanics, 2nd edn Cambridge University Press, Cambridge.