

CIV_ENV 454 – Constitutive Models for Soils
Spring Quarter 2023
Prof. Buscarnera, Tech A124, g-buscarnera@northwestern.edu

Course Outline:

Week 1

Lecture 1	Thu, 3/30	Introduction –Tensors and invariants (HW#1 assigned)
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Week 2

Lecture 2	Tue, 4/4	Work conjugation and field equations
Lecture 3	Thu, 4/6	<i>Tutorial:</i> Stress paths and elastic response

Week 3

Lecture 4	Tue, 4/11	Elastic models for soils
Lecture 5	Thu, 4/13	Plasticity theory (HW#1 due; HW#2 assigned)

Week 4

Lecture 6	Tue, 4/18	<i>Tutorial:</i> FE modeling with ABAQUS
Lecture 7	Thu, 4/20	<i>Tutorial:</i> Elastic stiffness tensor

Week 5

Lecture 8	Tue, 4/25	Failure criteria for soils
Lecture 9	Thu, 4/27	<i>Tutorial:</i> Yield surfaces & elastoplasticity (HW#2 due)

Week 6

Lecture 10	Tue, 5/2	Frictional plasticity (HW#3 assigned)
Lecture 11	Thu, 5/4	Critical state and Cam clay model

Week 7

Lecture 12	Tue, 5/9	<i>Tutorial:</i> Integration algorithms
Lecture 13	Thu, 5/11	Typical results of Cam clay model (HW#3 due)

Week 8

Lecture 14	Tue, 5/16	Constitutive models for sand (HW#4 assigned)
Lecture 15	Thu, 5/17	<i>Tutorial:</i> UMAT implementation

Week 9

Lecture 16	Tue, 5/23	Advanced models for structured soils
Lecture 17	Thu, 5/25	Viscoplasticity (HW#4 due)

Week 10

Lecture 18	Tue, 5/30	<i>Tutorial:</i> Algorithms for model calibration
Lecture 19	Thu, 6/1	FINAL EXAM

Week 11

Mon, 6/5	PROJECT PRESENTATIONS
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Course Location: Tech MG28

Textbook: *Constitutive modelling in geomechanics: introduction.* Springer Science & Business Media.

Grades:

Homework Assignments: 30%

Exam: 35%

Project Presentation: 30%

Class Participation: 5%