

Course Outline  
**Fundamentals of Geomechanics**  
CIVE 5801 (Winter 2021)

Department of Civil and Environmental Engineering  
Carleton University

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**Instructor:** Mehdi Pouragha  
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**Lectures:** Mondays 11:35–14:25  
**Location:** Online

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### Topics

- Introduction and Mathematical Preliminaries  
*Concept of coordinates; Basic vector and tensor calculus*
- Equilibrium and Stress Tensor  
*Cauchy stress tensor; Equilibrium equations; Divergence theorem; Stress invariants; Deviatoric stress; Stress space and Lode angle*
- Kinematics of continuum deformation  
*Lagrangian vs Eulerian description of motion; Displacement field and its derivatives; Deformation gradient and strain tensor*
- Constitutive laws- Elasticity  
*Basic principles of local action, determinism, and frame indifference; Conservation laws, Energy conjugates; Homogeneity order, Incremental linearity, Anisotropy; Hyper-elasticity; Anisotropic elasticity*
- Constitutive laws- Theory of Plasticity  
*Concept of plastic loading and path dependency; Hyper-plasticity, Yield and failure functions; Plastic flow rule; Associated vs non-associated plasticity*
- Cam clay theory

### Evaluation

- 40% Final, 30% Midterm, 30% Term paper (due at the end of the term)
- Midterm and final exams will be posted to the cuLearn page on the 9:00 am of the exam date and the students will have until midnight (11:59 pm) of the same day to submit their answers.
- A minimum of 35% in the midterm and final exams is required to obtain a passing grade.

### Course Delivery

We will have **synchronous** online sessions, using Zoom software, at the assigned lecture hours (M 11:35-14:25). Recording of the lectures will be posted to cuLearn. Note that students are strongly advised to attend the synchronous lectures since the interactive discussions during the lecture is vital to the understanding of the main concepts in this course.

## **Student Accommodation**

The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). Requests made within two weeks will be reviewed on a case-by-case basis. After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website ([www.carleton.ca/pmc](http://www.carleton.ca/pmc)) for the deadline to request accommodations for the formally-scheduled exam (if applicable).