ME-331 **Solid mechanics**

Curtin William

| Cursus | Sem. | Type |
|---|---|---|
| Mechanical engineering | BA6 | Obl. |

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| Language of teaching | English |
| Credits | 4 |
| Session | Summer |
| Semester | Spring |
| Exam | Written |
| Workload | 120h |
| Weeks | 14 |
| **Hours** | **4 weekly** |
| Courses | 3 weekly |
| Exercises | 1 weekly |
| **Number of positions** | |


## Summary

Model the behavior of elastic, viscoelastic, and inelastic solids both in the infinitesimal and finite-deformation regimes.


## Content

This course will articulate the behavior of elastic, viscoelastic, and inelastic solids both in the infinitesimal and finite-deformation regimes. Exact and approximate solutions to initial and boundary-value problems will be employed to analyze the stress and strain state of a finite body under different assumptions. The time/frequency dependence of viscoelastic materials will be presented. Certain constitutive models for strain and stress fields associated with permanent deformations are also analyzed.

## Keywords

Large deformations, Elasticity, Viscoelasticity, Plasticity.

## Learning Prerequisites

### Required courses

- Mechanics of Structures II (ME-232)
- Mechanics of continuous media (ME-201)

### Recommended courses

### Important concepts to start the course

Theory of ordinary differential equations
Theory of partial differential equations
Vector/Tensor operations and properties

## Learning Outcomes

By the end of the course, the student must be able to:

- Apply the concepts of rigid and deformable body mechanics and of continuum mechanics to model and solve analytically problems of statics, structural stress analysis or simple mechanisms, S1;
- Describe and identify the constitutive behaviour of a material from the results of a tensile, torsion or bending test and

choose a suitable test standard for the characterization of such behaviour. Derive a rheological model appropriate for the observed response, S5;

• Model with appropriate tools (analytical or numerical) the nonlinear (hyperelastic, plastic, buckling) and/or time-dependent (viscoelastic, viscoplastic) behaviour of structures and material under complex loadings, S12.

## Transversal skills

• Plan and carry out activities in a way which makes optimal use of available time and other resources.
• Continue to work through difficulties or initial failure to find optimal solutions.
• Take feedback (critique) and respond in an appropriate manner.

## Teaching methods

Ex-cathedra

## Expected student activities

Homework

## Assessment methods

There will be a midterm exam worth 30% and a written final exam worth 70& of the grade.

## Supervision

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|---|---|
| Office hours | Yes |
| Assistants | Yes |
| Forum | Yes |

## Resources

### Ressources en bibliothèque

• Applied Mechanics of Solids / Bower

### Notes/Handbook

A. Bower, *Applied Mechanics of Solids*, CRC Press, 2009

### Websites

• http://moodle.epfl.ch

## Prerequisite for

Computational Solid and Structural Dynamics (ME-473)
Fracture mechanics (ME-432)
Mechanics of composites (ME 430)