

ME-470

**Modeling of soft and biological matters**

Kim Sangwoo

Cursus	Sem.	Type
Mechanical engineering minor	H	Opt.
Mechanical engineering	MA1, MA3	Opt.
Mechanics		Obl.

Language of teaching	English
Credits	3
Withdrawal	Unauthorized
Session	Winter
Semester	Fall
Exam	During the semester
Workload	90h
Weeks	14
<b>Hours</b>	<b>3 weekly</b>
Lecture	2 weekly
Exercises	1 weekly

**Number of positions**

**Il n'est pas autorisé de se retirer de cette matière après le délai d'inscription.**

**Summary**

This course aims to provide students with a comprehensive understanding of theoretical and computation modeling approaches applicable to soft and biological matter.

**Content**

This course introduces basic concepts of continuum mechanics, thermodynamics, statistical mechanics, and differential geometry relevant to the modeling of soft and biological matter. In-depth case studies explore various individual systems, with an emphasis on biological systems, including topics such as:

- (1) Biopolymers
- (2) Network based materials
- (3) Membranes and vesicles
- (4) Single cell and cell clusters

**Keywords**

Biomechanics; Biophysics; Continuum mechanics; Soft condensed matter physics; Physics of living systems; Numerical methods

**Learning Prerequisites****Recommended courses**

- Continuum mechanics (ME-201)
- Solid mechanics (ME-331)
- Probability and statistics (MATH-234(d))
- Numerical analysis (MATH-251(e))

**Learning Outcomes**

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

- Model with analytical or numerical tools the nonlinear response of structures and materials, S12
- Explain the link between the physiology and the mechanical properties of a tissue, B2

### Transversal skills

- Demonstrate the capacity for critical thinking

### Teaching methods

Lectures & exercises

### Assessment methods

Assignments

Final exam

### Supervision

Office hours	Yes
Assistants	Yes
Forum	No

### Resources

#### Virtual desktop infrastructure (VDI)

No

### Bibliography

- Christopher R. Jacobs, Hayden Huang, and Ronald Y. Kwon, "Introduction to Cell Mechanics and Mechanobiology", Garland Science (2012)
- David Boal, "Mechanics of the cell", Cambridge University Press (2012)
- Rob Phillips, Jane Kondev, Julie Theriot, and Hernan Garcia, "Physical biology of the cell", Garland Science (2012)

### Moodle Link

- <https://go.epfl.ch/ME-470>