EPFL

MATH-251(a)	**Numerical analysis**

Antolin Sanchez Pablo, Sande Espen

Cursus	Sem.	Type
Civil Engineering	BA5	Obl.
Environmental Sciences and Engineering	BA5	Obl.
HES - SIE	H	Obl.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Lecture	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This course presents numerical methods for the solution of mathematical problems such as systems of linear and non-linear equations, functions approximation, integration and differentiation, and differential equations.

Content

- Polynomial approximation: interpolation and least squares
- Numerical differentiation and integration
- Direct methods for solving systems of linear equations
- Iterative methods for solving systems of linear and non-linear equations
- Numerical approximation of differential equations.

In the exercise lectures the student will implement and test the studied methods using Python.

Keywords

Numerical algorithms, polynomial interpolation, numerical integration, numerical linear algebra, numerical solution of ODEs, iterative methods.

Learning Prerequisites

Required courses

- Analyse
- Algèbre linéaire

Recommended courses

Programmation

Learning Outcomes

By the end of the course, the student must be able to:
- Choose a method for solving a specific problem
- Interpret in the light of theory the results obtained from a computation
- Estimate numerical errors

- Prove theoretical properties of numerical methods
- Implement numerical algorithms
- Apply numerical algorithms to specific problems
- Describe numerical methods
- State the theoretical properties of mathematical problems and numerical methods

Transversal skills

- Use both general and domain specific IT resources and tools
- Access and evaluate appropriate sources of information.

Teaching methods

Ex cathedra lectures, exercices in class and with computers

Expected student activities

- Attendance to lectures
- Exercises resolution
- Resolution of elementary problem with computers

Assessment methods

Written exam. The exam may require the resolution of problems in a computer using Python.

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

Yes

Bibliography

- Course's notes (English and French versions available).
- A. Quarteroni, P. Gervasio et F. Saleri : « Calcul Scientifique : Cours, exercices corrigés et illustrations en MATLAB et OCTAVE », Springer, 2010, ISBN 978-88-470-1676-7.
- A. Quarteroni et F. Saleri et P. Gervasio: « Scientific Computing with MATLAB and OCTAVE », Springer, 2014, ISBN 978-3-642-45367-0.
- A. Quarteroni, R. Sacco et F. Saleri : « Numerical Mathematics », Springer, 2007, ISBN 978-3-540-49809-4.
- J. Rappaz et M. Picasso: "Introduction à l'analyse numérique", PPUR - Collection: Enseignement des mathématiques - 2017

Ressources en bibliothèque

- Calcul scientifique / Quarteroni
- Scientific computing with MATLAB and OCTAVE / Quarteroni

- Numerical Mathematics / Quarteroni
- Introduction à l'analyse numérique / Rappaz & Picasso

Notes/Handbook

Available on the Moodle (English and French versions).

Moodle Link

- https://go.epfl.ch/MATH-251_a