

MATH-401

Advanced analysis II

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Cursus	Sem.	Type
Bioengineering	MA2, MA4	Opt.
SC master EPFL	MA2, MA4	Opt.
Sciences du vivant	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Oral
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Remark

Advanced Analysis I and Advanced Analysis II must be taken together as a whole

Summary

Getting access to the use of Banach spaces, Hilbert spaces, Fourier series, Fourier transforms and distributions.

Content

1. Inner product spaces and Hilbert spaces
2. L2 spaces
3. Orthonormal sets in Hilbert spaces: Fourier coefficients, Bessel inequality and equality
4. Periodic signals and Fourier series
5. Fourier Transform in L1 and in L2
6. Distribution spaces
7. Tempered distributions and Fourier transform

Keywords

inner product spaces, Hilbert spaces, Lp spaces, orthonormal sets, Fourier coefficients, Fourier transform, distributions, tempered distributions, periodic signals, Dirac comb, sampling of a signal

Learning Prerequisites**Recommended courses**

Advanced Analysis I

Learning Outcomes

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

- Explain the main concepts and propositions presented in the lecture
- Detect the main properties (as Banach, Hilbert, norm, inner product) in examples
- Exploit the main propositions in concrete examples
- Formalize the main tools used for signals (sampling,...)
- Theorize the environment in which Fourier analysis is performed

Transversal skills

- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Communicate effectively, being understood, including across different languages and cultures.

Teaching methods

Ex cathedra lecture and exercises in the classroom

Expected student activities

Understanding the mathematical language necessary for a deep understanding of signals and their transforms, of the Lebesgue spaces and the distribution spaces

Assessment methods

Oral exam

Resources

Bibliography

C. Gasquet, P. Witomski: Fourier Analysis and Applications, Springer, ISBN 0-387-98485-2
W. Kammler: A First Course in Fourier Analysis David, Online ISBN: 9780511619700 Hardback ISBN: 9780521883405 Paperback ISBN: 9780521709798

Ressources en bibliothèque

- [A First Course in Fourier Analysis David / Kammler](#)
- [Fourier Analysis and Applications / Gasquet](#)

Notes/Handbook

Lecture notes: Advanced Analysis II by Hans-Jörg Ruppen (Librairie La Fontaine)

Websites

- <http://cmspc11.epfl.ch/hjr>
- <https://cmspc11.epfl.ch/AFNextGen>

Prerequisite for

Diploma