

Module Handbook (<https://modhb.uni-kl.de/>)

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## Course MAT-70-14-K-7

Nonlinear Functional Analysis with Applications to PDE (2V, 4.5 LP)

### Course Type

SWS	Type	Course Form	CP (Effort)	Presence-Time / Self-Study
2	V	Lecture	4.5 CP	28 h / 107 h
(2V)			4.5 CP	28 h / 107 h

### Basedata

SWS	2V
CP, Effort	4.5 CP = 135 h
Position of the semester	1 Sem. irreg.
Level	[7] Master (Advanced)
Language	[EN] English
Lecturers	Klar, Axel, Prof. Dr. (PROF   DEPT: MAT) (/staff/18/) Pinnau, René, Prof. Dr. (PROF   DEPT: MAT) (/staff/27/) + further Lecturers of the department Mathematics
Area of study	[MAT-SPAS] Analysis and Stochastics
Additional informations	<a href="https://www.mathematik.uni-kl.de/techno/lehre/">Informations about the course</a> ( <a href="https://www.mathematik.uni-kl.de/techno/lehre/">https://www.mathematik.uni-kl.de/techno/lehre/</a> )
Lifecycle-State	[NORM] Active

#### Notice

This course cannot be used together with the course **[MAT-81-13-K-7]** (/mhb/courses/MAT-81-13-K-7/) because of large content overlaps.

#### Contents

From the large field of nonlinear functional analysis, methods and techniques are discussed which play a central role in the investigation of nonlinear elliptic and parabolic partial differential equations. In particular, the following contents are discussed:

- fixed point theorems,

- integration and differentiation in Banach spaces,
- the theory of monotone operators and their applications in the study of nonlinear elliptic and parabolic partial differential equations.

## Literature

- H. W. Alt: Lineare Funktionalanalysis,
- H. Gajewski, K. Gröger, K. Zacharias: Nichtlineare Operatorgleichungen und Operatordifferentialgleichungen,
- D. Gilbert, N. S. Trudinger: Elliptic partial differential equations of second order,
- E. Hille, S. Phillips: Functional analysis and semigroups,
- M. Ruzicka: Nichtlineare Funktionalanalysis: Eine Einführung,
- R. E. Showalter: Monotone operators in Banach space and nonlinear partial differential equations,
- K. Yoshida: Functional analysis,
- E. Zeidler: Nonlinear functional analysis and its applications I: Fixed-point theorems,
- E. Zeidler: Nonlinear functional analysis and its applications II/B.

## Materials

Further literature will be announced in the lecture.

## Requirements for attendance (informal)

Knowledge from the module **[MAT-81-11-M-7]** (/mhb/modules/MAT-81-11-M-7/) is desirable, but not necessarily required.

### Modules:

- [MAT-10-1-M-2] Fundamentals of Mathematics (M, 28.0 LP) (/mhb/modules/MAT-10-1-M-2/)
- [MAT-70-11-M-4] Functional Analysis (M, 9.0 LP) (/mhb/modules/MAT-70-11-M-4/)
- [MAT-80-11A-M-4] Numerics of ODE (M, 4.5 LP) (/mhb/modules/MAT-80-11A-M-4/)
- [MAT-80-11B-M-4] Introduction to PDE (M, 4.5 LP) (/mhb/modules/MAT-80-11B-M-4/)

## Requirements for attendance (formal)

None

## References to Course [MAT-70-14-K-7]

Module	Name	Context
[MAT-70-14-M-7 (/mhb/modules/MAT-70-14-M-7/)]	Nonlinear Functional Analysis with Applications to PDE	P: 2V, 4.5 Obligatory LP