

# Module Guide

## 24-M-ND-INPDE Introduction to Numerics of PDEs

Fakultät für Mathematik

*Version dated Dec 14, 2025*

This module guide reflects the current state and is subject to change. Up-to-date information and the latest version of this document can be found online via the page

<https://ekvv.uni-bielefeld.de/sinfo/publ/modul/533546218>

The current and valid provisions in the module guide are binding and further specify the subject-related regulations (German "FsB") published in the Official Announcements of Bielefeld University.

## 24-M-ND-INPDE Introduction to Numerics of PDEs

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### Faculty

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Fakultät für Mathematik

### Person responsible for module

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Herr Prof. Dr. Lubomir Banas

Herr Prof. Dr. Lars Diening

### Regular cycle (beginning)

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Every summer semester

### Credit points

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10 Credit points

### Competencies

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*Non-official translation of the module descriptions. Only the German version is legally binding.*

Students master the basic contents and methods of Numerical methods for PDE, in particular they can independently carry out complex proofs in this area requiring a high level of mathematical expertise. The students learn how partial differential equations are solved on the computer. They master the skills appropriate for the error analysis as well how to implement these simulations on the computer.

Furthermore, the students recognise further-reaching connections to mathematical facts already acquired. They can transfer and apply the knowledge and methods they have learnt so far to deeper mathematical problem areas. Students also expand their mathematical intuition as a result of more intensive study.

In the tutorials, students develop their ability to discuss mathematical topics and thus further prepare themselves for the requirements of the Master's module, in particular for the scientific discussion within the Master's seminar presentation and the defence of their Master's thesis.

### Content of teaching

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The following basic content of teaching from the field of Numerics of PDE is compulsory:

- Finite element methods for the simulation of solutions of PDEs, especially for elliptical PDEs
- approximation theory, interpolation operators, error analysis and adaptivity
- non-conforming finite element method
- finite methods for saddle point problems
- Stokes equations

### Recommended previous knowledge

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Solid knowledge of the basics of numerics

## Necessary requirements

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## Explanation regarding the elements of the module

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Module structure: 1 SL, 1 bPr<sup>1</sup>

## Courses

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Title	Type	Regular cycle	Workload <sup>5</sup>	LP <sup>2</sup>
Lecture Introduction to Numerics of PDEs	lecture	SoSe	60 h (60 + 0)	2 [Pr]
Tutorials Introduction to Numerics of PDEs	exercise	SoSe	90 h (30 + 60)	3 [SL]

## Study requirements

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Allocated examiner	Workload	LP <sup>2</sup>
<p>Teaching staff of the course <b>Tutorials Introduction to Numerics of PDEs (exercise)</b></p> <p><i>Regular completion of the exercises, each with a recognisable solution approach, as well as participation in the exercise groups for the module's lecture. As a rule, participation in the exercise group includes presenting solutions to exercises twice after being asked to do so as well as regular contributions to the scientific discussion in the exercise group, for example in the form of comments and questions on the proposed solutions presented. The organiser may replace some of the exercises with face-to-face exercises.</i></p>	see above	see above

## Examinations

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Allocated examiner	Type	Weighting	Workload	LP <sup>2</sup>
<p>Teaching staff of the course <b>Lecture Introduction to Numerics of PDEs (lecture)</b></p> <p><i>(electronic) written examination in presence of usually 120 minutes, oral examination in presence or remote of usually 40 minutes, A remote electronic written examination is not permitted.</i></p>	e-Klausur o. Klausur o. mündliche e-Prüfung o. mündliche Prüfung	1	150h	5

## Legend

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- 1 The module structure displays the required number of study requirements and examinations.
  - 2 LP is the short form for credit points.
  - 3 The figures in this column are the specialist semesters in which it is recommended to start the module. Depending on the individual study schedule, entirely different courses of study are possible and advisable.
  - 4 Explanations on mandatory option: "Obligation" means: This module is mandatory for the course of the studies; "Optional obligation" means: This module belongs to a number of modules available for selection under certain circumstances. This is more precisely regulated by the "Subject-related regulations" (see navigation).
  - 5 Workload (contact time + self-study)
- SoSe** Summer semester
- WiSe** Winter semester
- SL** study requirement
- Pr** Examination
- bPr** Number of examinations with grades
- uPr** Number of examinations without grades