Module Guide
24-M-AN-RTH Regularity Theory for Partial Differential Equations

Fakultät für Mathematik

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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/533552430

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-AN-RTH Regularity Theory for Partial Differential Equations

Faculty

Fakultät für Mathematik

Person responsible for module

Herr Prof. Dr. Moritz Kaßmann

Regular cycle (beginning)

This module is part of a long-term overall curriculum plan for the Master's programme, which ensures that modules with an amount of at least 20 CP are offered in all five fields each year. The module is offered at irregular intervals as part of this overall curriculum planning.

Credit points

10 Credit points

Competencies

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

Students master advanced content and methods of Regularity Theory for Partial Differential Equations, in particular they can independentlycarry out very complex proofs in this area requiring a high level of mathematical expertise. They are able to analyse regularity properties of solutions of partial and integro-differential equations. Emphasis will be put on elliptic and parabolic differential equations of differentiability order two. The students can apply and compare different solution concepts. They are able to apply core ideas of the theory, such as function spaces, approximations by finite differences and bootstrapping techniques, Sobolev and Hölder spaces including the embedding theorems, in different contexts.
Students will be introduced to current research questions in the field of Regularity Theory for Partial Differential Equations. They are able to recognise and assess further development opportunities and research goals.
Furthermore, students recognise further-reaching connections to mathematical issues that have already been worked out. 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 combination with other in-depth modules, they will be able to write their own research papers, e.g. a master's thesis in the field of Regularity Theory for Partial Differential Equations
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

The following advanced content of teaching from the field of Regularity Theory for Partial Differential Equations is compulsory:

- Difference-quotient method

- Sobolev regularity

- embedding theorems
- Calderon-Zygmund decomposition
- Schauder theory
- iteration techniques of De Giorgi and Moser

In addition, the following content of teaching can be covered, for example:

- Hölder-regularity for fully nonlinear partial differential equations
- kinetic equations
- degenerate partial differential equations
- Besov spaces

This module prepares the content of a master's thesis.

Recommended previous knowledge

Measure and Integration, Lebesgue spaces, basics knowledge of elliptic partial differential equations

Necessary requirements

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Explanation regarding the elements of the module

Module structure: 1 SL, 1 bPr [1]

Courses

Title	Type	Regular cycle	Workload [5]	LP[2]

Lecture Regularity Theory for Partial Differential Equations	lecture	This module is part of a long-term overall curriculum plan for the Master's programme, which ensures that modules with an amount of at least 20 CP are offered in all five fields each year. The module is offered at irregular intervals as part of this overall curriculum planning.	60 h (60 + 0)	2 [Pr]
Tutorials Regularity Theory for Partial Differential Equations	exercise	This module is part of a long-term overall curriculum plan for the Master's programme, which ensures that modules with an amount of at least 20 CP are offered in all five fields each year. The module is offered at irregular intervals as part of this overall curriculum planning.	90 h (30 + 60)	3 [SL]

Study requirements

Allocated examiner	Workload	LP²

Teaching staff of the course **Tutorials Regularity Theory for Partial Differential Equations (exercise)**	see above	see above
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		

Examinations

Allocated examiner	Type	Weighting	Workload	LP[2]
Teaching staff of the course **Lecture Regularity Theory for Partial Differential Equations (lecture)** *(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.*	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