

Area B – ANALYSIS AND DIFFERENTIAL EQUATIONS

Foundation in Analysis F4B1:

- **Functional Analysis and PDE** (Winter term)
- **PDE and Modeling** (not every year)
- **Global Analysis I** (Winter term)
- **Global Analysis II** (Summer term)

Lectures of Foundation modules may be taught in German.

Core Lecture Courses:

- **V4B1 Nonlinear PDEs I** (Winter term)
- **V4B2 Nonlinear PDEs II** (Summer term)
- **V4B3 Advanced Global Analysis I** (Winter term)
- **V4B4 Advanced Global Analysis II** (Summer term)
- **V4B5 Real and Harmonic Analysis** (not every year)

Advanced Lecture Courses:

- **V5B1 Advanced Topics in Analysis and PDE**
- **V5B2 Selected Topics in Analysis and PDE**
- **V5B3 Advanced Topics in PDE and Mathematical Models**
- **V5B4 Selected Topics in PDE and Mathematical Models**
- **V5B5 Advanced Topics in Analysis and Calculus of Variations**
- **V5B6 Selected Topics in Analysis and Calculus of Variations**

Typical Topics treated in advanced lecture courses include for example:

- Differential inclusions
- Entropy solutions
- Viscosity solutions
- Navier-Stokes equation
- Schrödinger equation, quantum mechanics
- Quasiconformal maps
- Gamma convergence, homogenization
- Global Analysis

Useful supplementary courses from other areas:

- **F4E1 Scientific Computing I and II**
- **F4F1 Stochastic Processes**
- **F4D1 Geometry**
- **V4E1 Numerical Algorithms**
- **V4E2 Numerical Simulation**
- **V4F1 Stochastic Analysis**
- **V4F2 Markov Processes**
- **NP420 Theoretische Physik III (Quantenmechanik)**
- **NP520 Theoretische Physik IV (Statistische Physik)**

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Recommended Curricula

- A good background in basic measure theory (Analysis III) is required and not part of Master studies.
- Background in functional analysis (including Sobolev spaces) and classical theory of PDEs is needed. If lacking, this may be acquired in the module F4B1. Permission of the Examination Board is required to enroll.
- Option I is intended for students who already have the complete background required. Options II and III are intended for students who did not learn functional analysis yet.
- At least one advanced lecture course is offered each winter term. One or more may be additionally offered in some summer terms, but this is not guaranteed.
- A typical curriculum with specialization in Analysis should include 3 or 4 lecture courses in Analysis.

Start in October:

- **Option I**
 1. Nonlinear PDE I
 2. Nonlinear PDE II or Real and Harmonic Analysis (+ Topics)
 3. Topics
 4. (Topics)
- **Option II**
 1. Functional analysis
 2. Nonlinear PDE II or Real and Harmonic Analysis
 3. Nonlinear PDE I (+ Topics)
 4. (Topics)
- **Option III**
 1. Functional Analysis + Nonlinear PDE I
 2. Nonlinear PDE II or Real and Harmonic Analysis
 3. (Topics)
 4. (Topics)
- **Option IV**
 2. Advanced Global Analysis I
 3. Advanced Global Analysis II
 4. Topics
 5. (Topics)

Start in April:

- **Option I**
 1. Nonlinear PDEs II or Real and Harmonic Analysis
 2. Nonlinear PDEs I (+ Topics)
 3. Topics
 4. (Topics)
- **Option II**
 1. Introduction to PDE (no credits for the master program!)
 2. Functional Analysis + Nonlinear PDE I
 3. Nonlinear PDE II or Real and Harmonic Analysis (+ Topics)
 5. (Topics)
- **Option III**
 1. PDE and Modeling
 2. Nonlinear PDE I (+ Topics)
 3. Nonlinear PDE II or Real and Harmonic Analysis
 4. (Topics)

Example Curriculum- Major Area B – Start in October

	Major (Area B)		Minor (Area F)	Minor (other)	Options
1	Nonlinear PDE I 9 CP		Graduate Seminar 6 CP	Markov Processes 9 CP	e.g. Discrete Mathematics Geometry Scientific Computing Quantum Mechanics Statistical Physics Mathematical Finance 17 CP
2	Nonlinear PDE II 9 CP	Graduate Seminar 6 CP	Advanced Topics in Probability Theory 7 CP	9 CP	
3	Advanced Topics 7 CP	Master Thesis 30 CP	Master Thesis Seminar 6 CP		
4	Selected Topics 5 CP				

Example Curriculum- Major Area B – Start in October

	Major (Area B)		Minor (Area D)	Minor (other)	Options
1	Advanced Global Analysis I 9 CP	Graduate Seminar 6 CP	Algebraic Topology I 9 CP	e.g. Discrete Mathematics Algebra Scientific Computing 9 CP	e.g. Practical Teaching Course External Internship Quantum Mechanics Statistical Physics Mathematical Finance 17 CP
2	Advanced Global Analysis II 9 CP	Graduate Seminar 6 CP	Advanced Topics in Topology 7 CP		
3	Advanced Topics 7 CP	Master Thesis 30 CP	Master Thesis Seminar 6 CP		
4	Selected Topics 5 CP				

Example Curriculum- Major Area B – Start in April

	Major (Area B)			Minor (Area F)	Minor (Area E)	Options
1	Nonlinear PDEs II 9 CP		Graduate Seminar 6 CP	Stochastic Processes 9 CP		e.g. Practical Teaching Course External Internship Quantum Mechanics Statistical Physics Mathematical Finance 15 CP
2	Nonlinear PDEs I 9 CP	Advanced Topics 7 CP	Graduate Seminar 6 CP		Scientific Computing I 9 CP	
3	Selected Topics 5 CP	Master Thesis 30 CP	Master Thesis Seminar 6 CP	Stochastic Analysis 9 CP		
4						