Area F – PROBABILITY AND STOCHASTIC ANALYSIS

Foundations in Probability and Stochastic Analysis F4F1:

- **Stochastic Processes** (Summer term)
- **Foundations in Stochastic Analysis** (Winter term)

Core Lecture Courses:

- **V4F1 Stochastic Analysis** (Summer term)
- **V4F2 Markov Processes** (Winter term)

Advanced Lecture Courses:

- **V5F1 Advanced Topics in Probability Theory**
- **V5F2 Selected Topics in Probability Theory**
- **V5F3 Advanced Topics in Stochastic Analysis**
- **V5F4 Selected Topics in Stochastic Analysis**
- **V5F5 Advanced Topics in Applied Probability**
- **V5F6 Selected Topics in Applied Probability**

Typical Topics treated in advanced lecture courses include for example:

- **Stochastic Analysis II** (e.g. stochastic flows, Malliavin calculus, stochastic partial differential equations, numerical stochastic analysis, stochastic differential geometry)
- **Markov Processes II** (e.g. interacting particle systems, Dirichlet forms and potential theory, functional inequalities, probability on graphs, branching processes, stochastic algorithms)
- **Mathematical Statistical Mechanics** (e.g. Gibbs measures and phase transitions, percolation, scaling limits, SLE)
- **Stochastic Finance** (e.g. Option Pricing, Econometrics, Optimal Stopping, Monte Carlo Methods)
- **Random Matrices** (e.g. applications to statistical physics, connections with particle systems, multivariate statistics)
- **Extreme Value Statistics**
- **Optimal Transport**

Useful supplementary courses from other areas:

- **F4B1 PDE and Functional Analysis** (Very important !)
- **F4B1 Global Analysis I**
- **V4B1 Nonlinear PDE I**
- **F4C1 Linear and Integer Optimization**
- **V4C2 Approximation Algorithms**
- **F4D1 Geometry I**
- **F4E1 Scientific Computing I**
- **V4E1 Numerical Algorithms**
- **NP420 Theoretische Physik III (Quantenmechanik)**
- **NP520 Theoretische Physik IV (Statistische Physik)**
- **Advanced courses in Economics**

Area F – PROBABILITY AND STOCHASTIC ANALYSIS

Recommended Curricula

- In all modules in Area F, a basic knowledge of probability theory is assumed. A background in functional analysis is helpful for some of the more advanced topics.
- If you did not take any measure theory based course on stochastic processes during your Bachelor studies, we recommend that you start with one of the Foundation modules “Stochastic Processes’’ or “Foundations in Stochastic Analysis’’, and take the core modules “Stochastic Analysis’’ and “Markov Processes’’ afterwards or in parallel (Option I).
- If you already wrote your Bachelor thesis in Area F, you may directly start with one of the core modules “Stochastic Analysis’’ or “Markov Processes’’ (Option II).

Start in October:

- **Option I**
  1. Foundations in Stochastic Analysis (+ Markov Processes)
  2. Stochastic Analysis
  3. Advanced Topics (+ Markov Processes if not in 1.)
  4. (Advanced or Selected Topics)
- **Option II**
  1. Markov Processes
  2. Stochastic Analysis (+ Advanced Topics)
  3. Advanced or Selected Topics
  4. (Selected Topics)

Start in April:

- **Option I**
  1. Stochastic Processes
  2. Markov Processes
  3. Stochastic Analysis + Advanced Topics
  4. (Advanced or Selected Topics)
- **Option II**
  1. Stochastic Analysis
  2. Markov Processes (+ Advanced Topics)
  3. Advanced or Selected Topics
  4. (Selected Topics)

Example Curriculum- Major Area F – Start in October

<table>
<tr><th></th><th colspan="3">Major
(Area F)</th><th>Minor
(Area B)</th><th>Minor
(other)</th><th>Options</th></tr>
<tr><td>1</td><td colspan="2">Markov Processes

9 CP</td><td>Graduate Seminar

6 CP</td><td>Functional Analysis and PDE

9 CP</td><td rowspan="2">e.g.

Discrete Mathe-matics

Geometry

Scientific Com-puting

9 CP</td><td rowspan="4">e.g.

Practical Teaching Course

External Internship

Quantum Mechanics

Statistical Physics

Mathe-matical Finance

15 CP</td></tr>
<tr><td>2</td><td>Advanced Topics

7 CP</td><td>Stochastic Analysis

9 CP</td><td>Graduate Seminar

6 CP</td><td></td></tr>
<tr><td>3</td><td rowspan="2">Selected Topics

5 CP</td><td rowspan="2">Master Thesis

30 CP</td><td rowspan="2">Master Thesis Seminar

6 CP</td><td>Nonlinear PDE I

9 CP</td><td rowspan="2"></td></tr>
<tr><td>4</td><td></td></tr>
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Example Curriculum- Major Area F – Start in April

<table>
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(Area C)</th><th>Minor
(Area B)</th><th>Options</th></tr>
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