Bocconi University
Ph.D. in Statistics and Computer Science 2021-2022

Stochastic Processes I

Discrete time stochastic processes.
Filtrations. Stopping times. Example: random walk. Conditional Distributions in Borel spaces. The Ionescu-Tulcea Theorem. Construction of Markov sequences.

Martingales.
Definition. Doob Decomposition. Transformations. The Optional Sampling Theorem. Applications. First and Second Wald identity. Inequalities and Convergence.

Renewal Sequences.
Definition. Potential measure. Measure generating functions. Strong law for renewal sequences. Delayed renewal sequences and coupling. The Renewal Theorem. Applications to random walks.

Markov sequences.
Transition operator and discrete generator. The Strong Markov property. Hitting times and return times. Renewal theory for Markov sequences. Irreducible Markov sequences. Equilibrium distribution.

Textbook:
Fristedt, B. and L. Gray: A Modern Approach to Probability Theory.

Exam Rules

Oral examination.