

Syllabus of the Comprehensive Exam

MATH 601 Stochastic differential equations and Applications

Topics

- **Introduction to Probability Theory:** Riemann integrals, Lebesgue's integrals, Finite variation, measurable functions, Axioms of Probability, probability measure and probability spaces. Conditional probabilities, Independent events.
- **Random variables:** Discrete and continuous random variables, Probability density function of a random variable, Expectation of a function of a random variable, Moments generating functions.
- **Limit theorems and Characteristic functions:** Conditional expectation, Limit Theorems, Characteristic functions, Properties of characteristic functions.
- **Stochastic processes:** Stochastic processes, Poisson Process, Martingales, Markov Chains, Brownian motion: Defining properties, Processes derived from Brownian motion.
- **Itô stochastic integrals:** Riemann-Stieltjes integral, Itô stochastic integral for simple processes, Itô formula, Extended version of Itô lemma.
- **Stochastic differential equations:** Stochastic Differential equations (SDEs), Solving SDEs, Linear stochastic differential equations, Applications of SDEs.

References

- B. Oksendal, *Stochastic Differential Equations: An Introduction with Applications*. 6th Edition. Springer 2010.
- S.M. Ross, *Introduction to Probability Models*. 10th Edition. Academic Press, 2010.