

LTCC Basic Statistics Course

- Course title: Measure-Theoretic Probability
- Basic Details:
 - Core Audience: Students with an interest in: Probability, Statistics, Analysis
 - Course format: Core
- Course description:
 - Keywords: Measure theory, sigma-field, random variable, stochastic process, martingale, diffusion, weak convergence, Brownian motion, Poisson process, Gaussian process
 - Syllabus: Measure-theory: probability as measure, random variable as measurable function, expectation as integral, filtration as information flow, probability spaces, filtered probability spaces [= stochastic bases]. Conditioning via Radon-Nikodym theorem; conditional expectation. Martingales, and the basic martingale convergence theorems.
Path properties; Markov and strong Markov processes; diffusions as path-continuous strong Markov processes, generators; properties and examples.
Brownian motion, Poisson process: existence and basic properties.
Lévy processes, Lévy-Khintchine formula, Lévy-Itô decomposition (without proofs).
Gaussian processes and random fields.
As time allows: Introduction to Itô calculus.
- Recommended reading:

David Williams, *Probability with Martingales*, CUP, 1991.
- Additional/Optional reading:

O. Kallenberg, *Foundations of Modern Probability*, 2nd ed., Springer 2002.
G. R. Grimmett and D. Stirzaker, *Probability and Random Processes*, 3rd ed., OUP, 2001 [ch. 12 and 13]
J. M. Steele, *Stochastic Calculus and Financial Applications*, Springer 2001 [ch. 1-6].
- Format:
 - No. of discussion/problem sheets: 4
 - Electronic lecture notes: TeX lecture notes will be provided as handouts, used on OHP in lectures, and posted on the course website.
 - Necessary support facilities: None (apart from the above)
 - Necessary software requirements for computing facilities None
 - Lecture/Computer session split: 10/0h

- Lecturer's details:
 - Lecturer: Professor N. H. Bingham
 - Lecturer's home institution: Mathematics Department, Imperial College and Mathematics Department, LSE.