

LTCC Proposed Course

- Title: Stochastic Processes
- Basic Details:
 - Core Audience: Statistics
 - Course Format: Basic/Core (10 h)

1 Course Description

Syllabus The course aims to introduce the main ideas and methods of simple applied probability, covering the following topics, together with examples of a variety of applications.

1. A brief review of prerequisites (see below) and further discussion of Markov chains in discrete and continuous time; to include random walks, branching processes, reversibility, embedded chains, simulation and estimation. Examples of use of forward and backward decompositions, reversibility arguments and embedded chains.
2. Point processes in time and space; to include complete and conditional intensities, superposition and thinning, Poisson-based processes, Markov random fields.
3. Epidemic models; to include thresholds, deterministic and moment closure approximations, population structure, host heterogeneity and heterogeneity of mixing, epidemics on networks.

Recommended reading

- Hakan Andersson and Tom Britton (2000) *Stochastic Epidemic Models and their Statistical Analysis*, Springer Lecture Notes in Statistics no.151.
- DR Cox and Valerie Isham (1980) *Point Processes*, Chapman & Hall.
- Geoffrey Grimmett and David Stirzaker (2001) *Probability and Random Processes*, 3rd edn, Oxford University Press.

Additional optional reading

- Daryl Daley and David Vere-Jones (2003) *An Introduction to the Theory of Point Processes, Volume I: Elementary Theory and Methods*, Springer.
- Valerie Isham (2005) Stochastic models for epidemics: current issues and developments. In *Celebrating Statistics*, Eds A.C. Davison, Y. Dodge and N. Wermuth. Oxford University Press, pp 27–54.
- Jesper Møller and Rasmus P Waagepetersen (2007) Modern statistics for spatial point processes (with discussion). *Scand. J. Statist.* **34**, 643-711.
- Sheldon Ross (1996) *Stochastic Processes*, Wiley.

Prerequisites

Knowledge of Markov processes with discrete state spaces at a level typical of introductory undergraduate courses in applied probability—to include, in discrete time, transient and equilibrium behaviour, first passage times and classification of states; in continuous time, Poisson and birth-death processes.

Recommended texts:

- Sheldon M. Ross *Introduction to Probability Models* (Academic Press, 2007, 9th edition), sections 4.1–4.4, 5.3, 6.1–6.5.;
- David Stirzaker *Stochastic Models and Processes* (Oxford University Press, 2005), sections 2.5, 3.1–3.6, 4.1–4.6.

- Format:

- No. of problem sheets: 4.
- Electronic lecture notes: Yes.
- Necessary support facilities: None
- Necessary software requirements for computing facilities: None
- Proposed timing: 25 February - 18 March 2008.
- Lecture/computer session/tutorial/discussion split: 8/0/0/2

Part of each 2-hour session will be set aside to discuss issues arising from the current lecture or from the problems and/or reading set the previous week.

- Lecturer Details:

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