

Introduction to Markov Processes in Continuous Time

Course title – Intitulé du cours	Introduction to Markov Processes in Continuous Time
Level / Semester – Niveau /semestre	M2 – Semester 2
School – Composante	Ecole d'Economie de Toulouse
Teacher – Enseignant responsable	Laurent Miclo
Other teacher(s) – Autre(s) enseignant(s)	
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Other teacher(s) – Autre(s) enseignant(s)	
Lecture Hours – Volume Horaire CM	15h
TA Hours – Volume horaire TD	
TP Hours – Volume horaire TP	
Course Language – Langue du cours	English
TA and/or TP Language – Langue des TD et/ou TP	

Teaching staff contacts – Coordonnées de l'équipe pédagogique :

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Course Objectives – Objectifs du cours :

This course will introduce continuous time Markov processes and cover a selection among the following topics:

- Unifying definition of Markov processes via generators and martingale problems
- Classical examples: finite jump processes, Poisson, Brownian motion, Ornstein-Uhlenbeck, diffusions
- Martingale bracket, carré du champs and Girsanov formulas
- Convergence to equilibrium and functional inequalities: spectral gap, isoperimetry, logarithmic Sobolev, cut-off, strong stationary times
- Poisson equation: law of large numbers and central limit theorem for ergodic Markov processes
- Stochastic algorithms for sampling and global optimization: Metropolis, simulated annealing and Hamiltonian Monte-Carlo
- Interacting particle systems, mean field and non-linear Markov processes
- Applications to Finance and Economics

Prerequisites – Pré requis :

The courses “Markov Chains and Applications” (semester 1) and knowledge of conditional expectations, e.g. from the first lessons of “Martingale Theory and Applications” (semester 2)

Practical information about the sessions – Modalités pratiques de gestion du cours :

Grading system – Modalités d'évaluation :

Bibliography/references – Bibliographie/références :

Session planning – Planification des séances

Distance learning – Enseignement à distance :

Distance learning can be provided when necessary by implementing:

- *Interactive virtual classrooms*
- *Recorded lectures (videos)*
- *MCQ tests and other online exercises / assignments*
- *Remote (online) tutorials (classes)*
- *Chatrooms*

En cas de nécessité, un enseignement à distance sera assuré en mobilisant:

- *Classe en ligne interactive*
- *Vidéo enregistrée de la présentation du matériel pédagogique*
- *QCM et exercices en ligne*
- *TP/TD à distance*
- *Forum...*