



Course Syllabus for
DAUSY National Ph.D. Program in Autonomous Systems
(year 2022-23)

Course title	Stochastic approaches in Systems Biology
Scientific Discipline Sector	ING-INF/04
Hours of instruction	15 hours
CFU	1.5 CFU
Semester, period	January-February 2023
Goal	This course gives the mathematical tools to model and analyze most common biological frameworks such as chemical reaction and gene transcription networks, according to the stochastic approach of the Chemical Master Equations
Syllabus	<ul style="list-style-type: none"> - The kind of chemical reactions, and their mathematical representation: the stoichiometric matrix. Mass action law and fluxes - The stochastic approach: Chemical Master Equations (CME). CMEs modeled by Continuous-Time Markov Chains - The Gillespie Algorithm - Moment computations - The Langevin equation - Examples from enzymatic/metabolic reactions and gene transcription networks
Bibliography	<ul style="list-style-type: none"> - N.G.. Van Kampen, Stochastic Processes in Physics and Chemistry, 3rd edition, North Holland, 2007 - E. Klipp, W. Liebermeister, C. Wierling, and A. Kowald, Systems biology: a textbook, John Wiley & Sons, 2016. - Slides and support material from lecturer
Examination method	Final examination by oral questions