Course unit English denomination	Probability Theory
SS	MATH-03/B
Teacher in charge (if defined)	Athena Picarelli Stefano Rizzelli
Teaching Hours	42
Number of ECTS credits allocated	7
Course period	11/2026-01/2027
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (100% minimum of presence, apart from exceptional absences that must be justify in advance) ☐ No
Course unit contents	- Basics on probability spaces and random variables. Independence of random variables. - Conditional distribution and expectations. Characteristic and moment generating functions. Functions of random variables - Order statistics and martingales. Normal distribution theory. - Convergence of random variables and review of limit theorems: Laws of Large Numbers and Central Limit Theorems. - Stochastic processes: general definitions, filtrations, martingales, stopping times. - Discrete time Markov processes: Markov property and transition matrix. Canonical representations. Communication, irreducibility and periods. Stationarity. Convergence to steady state. Renewal equation and renewal theorem. Time to absorption and probability of absorption. - Generalities on continuous-time stochastic processes. Poisson process. Continuous time Markov chains: transition semigroup, infinitesimal generator. Diffusion processes.
Learning goals	The students are supposed to achieve a deep knowledge of probability theory starting from basic concepts to more advanced ones. Objective of the course is to provide theoretical insights on the topics and use them for solving practical exercises.
Teaching methods	Lectures
Course on transversal, interdisciplinary, transdisciplinary skills	☐ Yes ☒ No

Available for PhD students from other courses	☒ Yes ☐ No Students from other PhD courses may be admitted subject to CV evaluation by the Faculty Board
Prerequisites (not mandatory)	Basic notions on Probability
Examination methods (if applicable)	Written Test
Suggested readings	Course material available from the instructor
Additional information	max 3750 caratteri