

The Stochastic Processes and their Applications

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Calendario: 20 ore svolte il 19, 21, 22, 26, 28, 29 maggio, 4, 5, 9, 11 giugno, Aula 2BC/30, Torre Archimede.

Prerequisiti: nozioni di base di Calcolo delle Probabilità (utili, ma non necessarie)

Tipologia di esame: colloquio orale.

SSD: MAT/06

Programma del corso:

A. THEORY

1. Brief Review of Probability Theory
2. Some Facts from Matrix Theory
3. Discrete Time Markov Chains
4. Brownian motion and Diffusion Processes
5. Ito Stochastic Integral and Stochastic Chain Rule (Ito Formula)
6. Stochastic Differential Equations
7. Poisson Processes

B. APPLICATIONS

B-I (Biology Track):

1. Biological Applications of Discrete Time Markov Chains:
 - (a) general birth and death process
 - (b) logistic growth process
 - (c) genetic inbreeding problem
2. Biological Applications of Stochastic Differential Equations:
 - (a) stochastic linear growth model
 - (b) stochastic logistic growth process with environmental variations
 - (c) stochastic epidemic models

B-II (Electrical and Computer Engineering Track): Modelling of random phenomena in electrical and computer systems:

- (a) Mathematical representation of stochastic dynamic systems
- (b) signal processing, detection, estimation, and communication
- (c) Controllability and observability

B-III (Physics and Chemistry Track):

- (a) The Fokker-Planck equation
- (b) Stochastic behavior of quantum systems
- (c) Quantum-mechanical Markov Processes
- (d) Stochastic dynamic systems in optics
- (e) Stochastic chemical kinetics