

## MASTER Economics Stochastic finance

### Contact

Sebastien DARSEES  
sebastien.darses@univ-amu.fr

### Description

Part of course.  
Code: PA-ME5BEC-BECCV27A  
Domain: Law, Economics,  
Management

### Information

<http://formations.univ-amu.fr>  
Department: Faculty of Economics  
and Management  
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### CONTENT

The aim of the course is to provide students with mathematical methods that allow valuating financial assets.

#### Course outline :

1. Gaussian variables and stochastic processes
  - 1.1 Unidimensional Gaussian variable
  - 1.2 Gaussian vectors
  - 1.3 Stochastic processes
2. Brownian motion
  - 2.1 Construction as a Gaussian process
  - 2.2 Expansion, Markov property and martingale
  - 2.3 Invariance property
  - 2.4 Trajectorial property
  - 2.5 Complement on Brownian bridge
3. Stochastic integration and semimartingale
  - 3.1 Integrating with respect to a Brownian motion
  - 3.2 Introduction to the general theory of stochastic integration
  - 3.3 Itô formula and first applications
4. Stochastic differential equation
  - 4.1 Elements of motivation
  - 4.2 Strong solutions
  - 4.3 Some examples
5. Parabolic SDE, brownian diffusion and semigroups
  - 5.1 Brownian motion and linear parabolic SDE
  - 5.2 The general Feynman-Kac formula
  - 5.3 Semigroups
6. Change of measure
  - 6.1 Wiener space
  - 6.2 Change of measure and Girsanov theorem
7. Introduction to financial mathematics
  - 7.1 Black and Scholes model
  - 7.2 Portfolio and option replication

### PROFESSIONAL SKILLS

Understand the mathematical framework and assumptions of the classical stochastic finance models.

### BIBLIOGRAPHY

- Lamberton, D. et Lapeyre, B. Introduction au calcul stochastique appliqué à la finance, Paris : Ellipses, 1997.
- El Karoui, N. et Gobet, E. Les Outils Stochastiques des Marchés Financiers : Une Visite Guidée de Einstein à Black-Scholes. Palaiseau : Les Editions de l'Ecole Polytechnique, 2011.
- Pardoux, E. Processus de Markov et Applications : Algorithmes, Réseaux, Génome et Finance. Dunod, 2007.

### ORGANISATION

This course is given through 24 hours of lecture at Ecole Centrale Marseille.

### FUNDAMENTAL PREREQUISITES

Knowledge in probability (including conditional expectation).

### VOLUME OF TEACHINGS

- Lectures: 24 hours

### TRAINING

#### Master's degree: Economics

- Quantitative finance and insurance

