

Partager



Email destinataire :

Vous devez renseigner un email valide

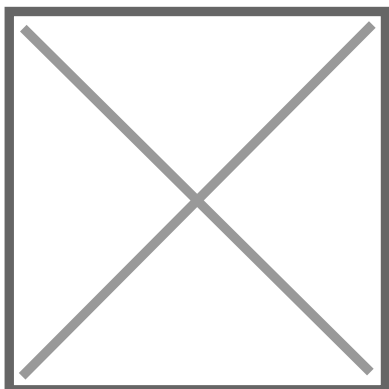
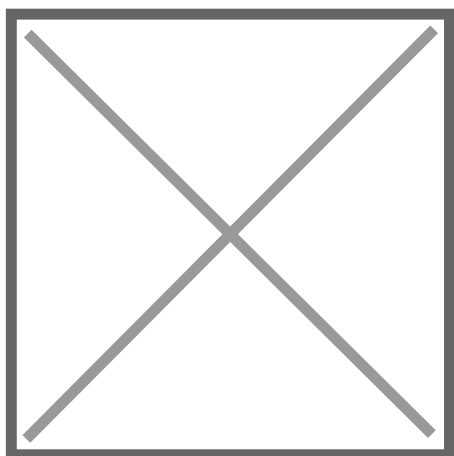
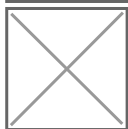
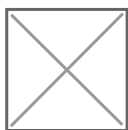
Envoyer

Une erreur est survenue. Merci de réessayer ultérieurement

Le mail de partage a bien été envoyé.

Ajouter au comparateur

M2 Finance quantitative



Master

Mention Mathématiques et applications

Régime(s) d'inscription

Formation initiale Formation continue

Langue(s) d'enseignement

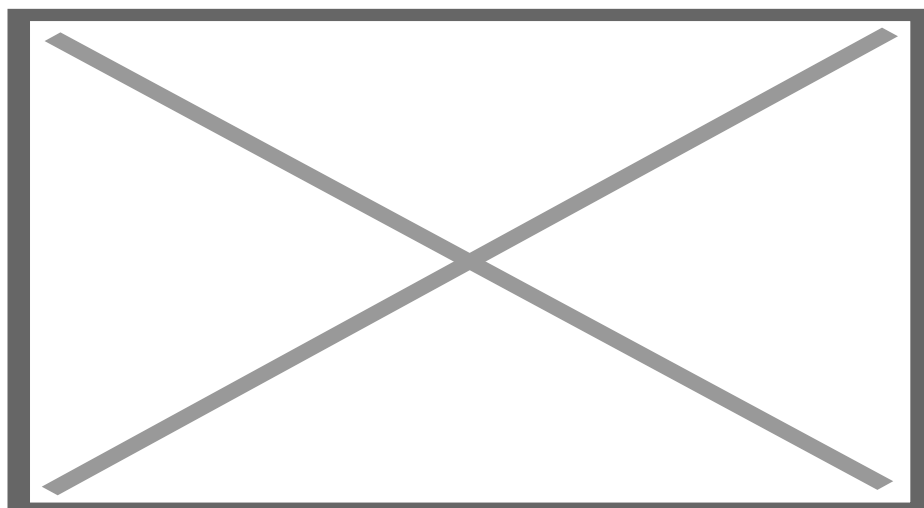
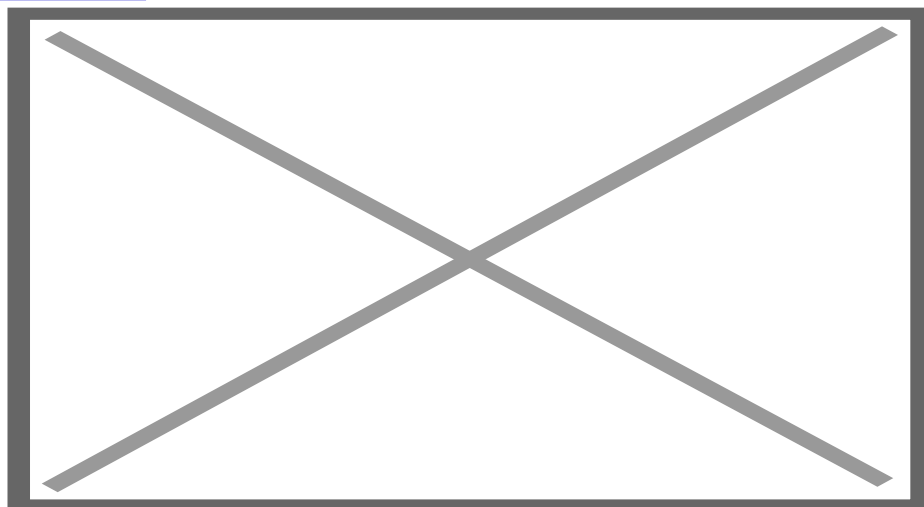
Anglais Français

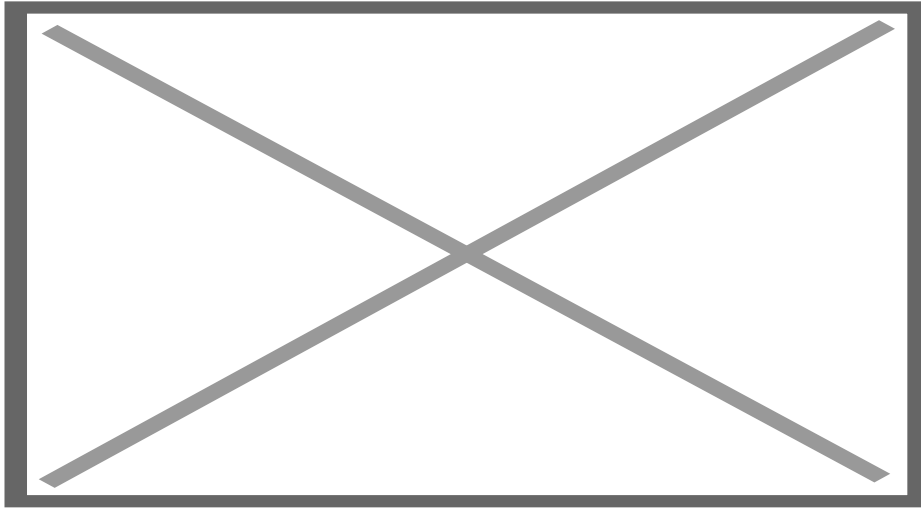
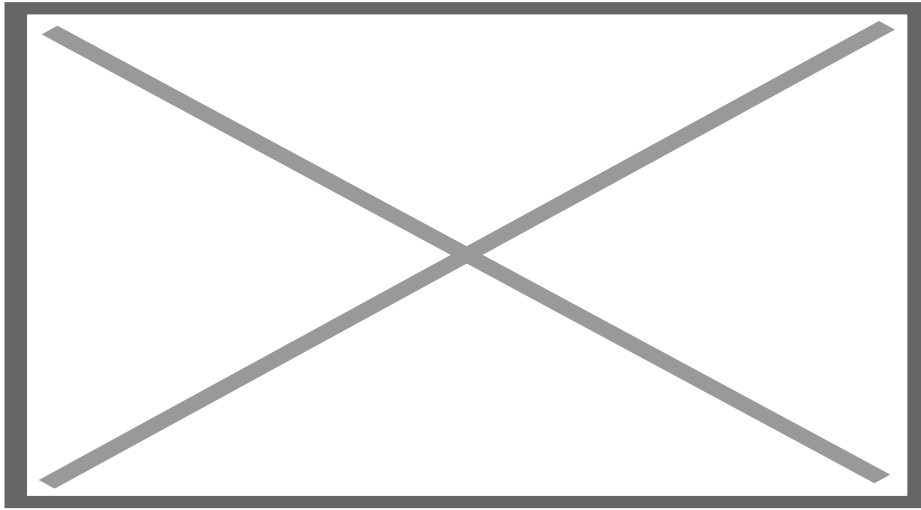
Le Master 2 Finance Quantitative de l'Université Paris-Saclay forme des spécialistes en modélisation financière, gestion des risques et valorisation des produits dérivés. Alliant théorie et pratique, il met l'accent sur les méthodes numériques avancées, le machine learning et le deep learning appliqués à la finance. Les étudiants acquièrent les compétences pour devenir des quants performants en finance de marché, gestion d'actifs ou recherche académique.

Le Master 2 Finance Quantitative se déroule sur un an et combine cours théoriques avancés, enseignements appliqués et projets pratiques. Le premier semestre est consacré aux fondamentaux en modélisation, méthodes numériques et machine learning. Le second semestre inclut un stage en entreprise ou en laboratoire de recherche, permettant aux étudiants de mettre en pratique leurs compétences et de préparer leur insertion professionnelle ou une thèse académique.

[Télécharger la fiche détaillée](#)

[Je candidate](#)





■ ■

Informations

- [Présentation](#)
- [Admission](#)
- [Programme](#)

Présentation

Compétences

Savoir formaliser mathématiquement un problème quantitatif issu de la finance de marché.

Objectifs pédagogiques de la formation

Former des ingénieurs spécialisés dans le domaine de la finance de marché, avec une excellente maîtrise des outils mathématiques, probabilités numériques, statistiques (machine learning), et de programmation associés.

Admission

Capacité d'accueil

Places

30

Public visé et prérequis

Compétences à un bon niveau de M1 ou équivalent en probabilités et statistiques, finance de marché, programmation (en C, python)

Période(s) de candidature

Plateforme Inception

Du 30/01/2026 au 30/06/2026

Pièces justificatives

Obligatoires

Lettre de motivation.

Tous les relevés de notes des années/semestres validés depuis le BAC à la date de la candidature.

Curriculum Vitae.

Facultatives

Attestation de niveau d'anglais.

Dossier VAPP (obligatoire pour toutes les personnes demandant une validation des acquis pour accéder à la formation) <https://www.universite-paris-saclay.fr/formation/formation-continue/validation-des-acquis-de-lexperience>.

Document justificatif des candidats exilés ayant un statut de réfugié, protection subsidiaire ou protection temporaire en France ou à l'étranger (facultatif mais recommandé, un seul document à fournir) :

- Carte de séjour mention réfugié du pays du premier asile
- OU récépissé mention réfugié du pays du premier asile
- OU document du Haut Commissariat des Nations unies pour les réfugiés reconnaissant le statut de réfugié
- OU récépissé mention réfugié délivré en France
- OU carte de séjour avec mention réfugié délivré en France
- OU document faisant état du statut de bénéficiaire de la protection subsidiaire en France ou à l'étranger.

Programme

UEs optionnelles

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
Produits dérivés	4	Semestre 2	47								

Produits dérivés

ECTS : 4

Semestre calendaire : Semestre 2

Détail du volume horaire

Cours magistraux : 47

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

Course of Finance of the 1st semester, Stochastic calculus, numerical finance

FX : Course of Finance of the 1st semester

VOLATILITY : Stochastic calculus, mathematical finance, and numerical finance at MSc level.

STRUCTURED PRODUCTS: Course of Finance of the 1st semester

Programme / plan / contenus

INTEREST RATES:

- basic principles of rate curve modelling; methods used in active bond management and «Bond Picking»; understanding of structured rate products; pricing of options in a rate model in the form of a concrete case

FX:

The goal of this lesson is to present the main characteristics of foreign exchange derivative products and their use, as part of managing currency risks for companies.

VOLATILITY:

A growing body of empirical research indicates that volatility fluctuates more rapidly than Brownian motion. Fractional volatility models have emerged as compelling alternatives. Even though tractability can be a challenge for these non-Markovian, non-semimartingales models, recent studies have developed numerical methods suitable for their implementation.

STRUCTURED PRODUCTS:

The objective of the course is to give an all-around comprehensive general knowledge and understanding of the theory and the day-to-day use of options for trading, hedging and arbitrage purposes.

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
<u>Systèmes de particules, jeux à champs moyen et application en machine learning et en finance</u>	4	Semestre 2	21	21							

Systèmes de particules, jeux à champs moyen et application en machine learning et en finance

ECTS : 4

Semestre calendaire : Semestre 2

Détail du volume horaire

Cours magistraux : 21

Travaux dirigés : 21

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

Calculus and probability at a good M1 level. Some knowledge of continuous-time processes at the level of the first semester course “stochastic calculus” is a plus but not mandatory.

Programme / plan / contenus

- Particle systems
- Propagation of chaos
- McKean type diffusions
- Mean field games
- Applications to machine learning and finance

Objectifs d'apprentissage

The aim of this course is to provide students with a comprehensive understanding of particle systems, McKean type diffusion, mean field games and their applications to machine learning and finance

Organisation générale et modalités pédagogiques

Course ensured by Prof. Zhenjie REN

Bibliographie

Carmona and Delarue. Probabilistic Theory of Mean Field Games with Applications I and II (2018)

Nature de l'évaluation

Evaluation Continue non Intégrale

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
<u>Contrôle et modélisation stochastique en finance et en assurance</u>	4	Semestre 2	42								

Contrôle et modélisation stochastique en finance et en assurance

ECTS : 4

Semestre calendaire : Semestre 2

Détail du volume horaire

Cours magistraux : 42

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

STOCHASTIC CONTROL: Probability, Stochastic calculus

CORPORATE FINANCE AND INSURANCE
MODELING: Probability, Stochastic calculus

Programme / plan / contenus

STOCHASTIC CONTROL: I Formulation of control problem

1. Optimal stopping
2. Switching regime and impulse control
3. Regular and singular control II Probabilistic methods 1.Duality methods 2.Optimal stopping with infinite maturity 3.Early exercise premium 4.Optimal dividend distribution III Dynamic programming and Hamilton-Jacobi-Bellman equation 1.Dynamic programming 2.HJB equation and verification theorem 3.Viscosity solutions IV Backward Stochastic Differential Equations 1.Solutions of BSDE 2.Quadratic BSDE and Examples CORPORATE FINANCE AND INSURANCE MODELING: I Corporate Finance
4. Model of firm value
5. Balance sheet and fundings problems
6. Structural models of bankruptcy II Investment strategies
7. Optimal investment strategies
8. Investment, dividends and liquidity III Capital structure
9. Modeling liabilities : equity and debts
10. Issuing capital and bankruptcy IV Models for insurance
11. Ruin theory
12. Dividends strategy under ruin constraints

Obiectifs d'apprentissage

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
<u>Cutting edge finance</u>	4	Semestre 2		64							

Cutting edge finance

ECTS : 4

Semestre calendaire : Semestre 2

Détail du volume horaire

Travaux dirigés : 64

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

First semester courses related to the topic of the project.

Programme / plan / contenus

The cutting edge projects in finance allow groups of four/five students (including a team leader) to deepen a subject under the responsibility of a professional (team mentor). They offer students and professionals the opportunity for mutually beneficial collaboration. The students deploy their technical expertise in an adventure also mobilizing their creativity, team spirit and professionalism. The professional finds a chance to renew his look on his field and benefits from the students' investment.

Objectifs d'apprentissage

Deepen a subject in quantitative finance under the responsibility of a professional

Organisation générale et modalités pédagogiques

The subjects that relate to market finance, insurance finance but also data mining, machine learning, etc. (in line with the master program curriculum) are defined by the professional. The project starts in December and ends at the end of March. Students meet with their professional manager at least 3 times in the meantime. A co-supervision by an academic member of the pedagogical team of the master program ensures the daily follow-up. The project gives rise to the delivery to the company of a commented code as well as a defense (oral presentation) with beamer slides or jupyter notebook at the end of March.

Modalités pédagogiques particulières

UEVE prend en charge 21,5HETD, le reste est pris en charge par l'ENSIIE.

Bibliographie

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
<u>FINANCE DURABLE ET ASSET MANAGEMENT</u>	2	Semestre 2	24								



FINANCE DURABLE ET ASSET MANAGEMENT

ECTS : 2

Semestre calendaire : Semestre 2

Détail du volume horaire

Cours magistraux : 24

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

Courses in finance in First semester M2 and in M1

Programme / plan / contenus

ADVANCED ASSET MANAGEMENT:

1. Risk-Based Investing a. Modern Portfolio Theory b. Risk Budgeting Approach c. Smart Beta & Risk-Based Indexation d. Application to Bond & Credit Portfolios e. Risk Parity & Portfolio Allocation
2. Risk Premia Investing a. The Theory of Risk Premia b. Skewness Risk Premia versus Market Anomalies c. Factor Investing in Equities d. Factor Investing in Corporate Bonds e. Asset Allocation with Alternative Risk Premia
3. Advanced Topics a. ESG Investing b. Large-scale Optimization & Portfolio Optimization c. Robo-Advisors d. Machine Learning, Gaussian Processes, Bayesian Optimization & Trading Model Calibration.

Objectifs d'apprentissage

This course provides advanced techniques in asset management and introduces the concept of sustainable finance.

Organisation générale et modalités pédagogiques

24 hours of lectures

Bibliographie

Roncalli T., Introduction to Risk Parity & Budgeting, Chapman & Hall, 2013. Roncalli, T. (2017), Alternative Risk Premia: What Do We Know?, Chapter 10 of the book Factor Investing: From Traditional to Alternative Risk Premia.

Nature de l'évaluation

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
Techniques de machine learning en finance	2	Semestre 2	21								

Techniques de machine learning en finance

ECTS : 2

Semestre calendaire : Semestre 2

Détail du volume horaire

Cours magistraux : 21

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

MACHINE LEARNING TECHNIQUES FOR OPTION PRICING, CALIBRATION, AND HEDGING APPLICATIONS: Financial modeling and numerical knowledge and skills, such as provided by the first semester course “Pricing and calibration methods in finance” General “machine learning” and “deep learning” knowledge and skills, such as provided by the eponymous first semester courses.

Programme / plan / contenus

MACHINE LEARNING TECHNIQUES FOR OPTION PRICING, CALIBRATION, AND HEDGING APPLICATIONS: In recent years, machine learning techniques have emerged as a generic, model-free, financial derivative numerical paradigm. This course module will be devoted to the option pricing, calibration, and hedging applications of machine learning, with a focus on deep neural networks (mainly), and also Gaussian process regression techniques

Objectifs d'apprentissage

Introducing the main relevant applications of very recent machine learning technics in quantitative finance

Organisation générale et modalités pédagogiques

MACHINE LEARNING TECHNIQUES FOR OPTION PRICING, CALIBRATION, AND HEDGING APPLICATIONS: beamer slides course, tutorials in python / tensorflow (local jupyter notebooks, after local installation of the required packages including anaconda and tensorflow, or notebooks executed online on the google collaborative platform).

Bibliographie

Statistical machine learning for quantitative finance
Ludkovski M. Annu Rev Stat Appl 10 (2023)

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
<u>Données Haute Fréquence et carnets d'ordre</u>	2	Semestre 2	24								



Données Haute Fréquence et carnets d'ordre

ECTS : 2

Semestre calendaire : Semestre 2

Détail du volume horaire

Cours magistraux : 24

Langue d'enseignement

Français

Enseignement à distance

non

Prérequis

Calcul stochastique, Python

Programme / plan / contenus

1 : High-frequency financial data and limit order books I.

Lab: Stylized facts on trade data.

2 : High-frequency financial data and limit order books II.

Lab: Stylized facts on quote data.

3 : Introduction to point processes I. Lab : Poisson processes.

4 : Introduction to point processes II. Lab : Hawkes processes.

5 : Hawkes processes in finance.

Lab : Hawkes processes and high-frequency transaction data.

6 : Mathematical modeling of limit order books. Lab : Poisson LOB simulation.

7 : An introduction to market impact.

Lab : Empirical market impact of LOB events.

Objectifs d'apprentissage

This course is aimed at students interested in the empirical study, mathematical modeling and numerical simulation of modern financial markets, known as order book markets.

Organisation générale et modalités pédagogiques

Class (10H30), Python practical (10H30).

Bibliographie

Abergel, Frédéric, Anane, Marouane, Chakraborti, Anirban, Jedidi, Aymen, & Muni Toke, Ioane (2016). Limit order books. Cambridge University Press.
Hasbrouck, J. (2007). Empirical market microstructure: The institutions, economics, and econometrics of securities trading. Oxford University Press.

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
<u>XVAs et régulations</u>	2	Semestre 2	22.5								



XVAs et régulations

ECTS : 2

Semestre calendaire : Semestre 2

Détail du volume horaire

Cours magistraux : 22.5

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

Financial modeling and numerical knowledge and skills, such as provided by the first semester course “Pricing and calibration methods in finance”

Machine learning in finance knowledge and skills, such as provided by the eponymous January module.

Some knowledge of corporate finance is also useful but will be recalled during the course.

Programme / plan / contenus

Since 2008, investment banks compute various X-valuation adjustments (XVAs) to assess counterparty risk and its capital and funding implications. XVAs matter at two different levels. First, trade incremental XVAs are charged to clients as add-ons to deal entry prices. Second, some of the XVA metrics are also accounting entries that affect the result of the bank. More broadly, the advent of these metrics reflects a shift of paradigm in derivative management, from hedging to balance-sheet optimization. First generation XVAs (CVA, DVA, and FVA, where C sits for credit, D for debt, and F for funding) pose the challenge of a proper understanding of the distinction between firm and shareholder valuation for their purpose. Second generation XVAs involve not only conditional expectations (i.e. prices), but also conditional risk measures: value-at-risk, which underlies MVA (margin valuation adjustment) computations, and expected shortfall, which underlies economic capital based KVA.

Objectifs d'apprentissage

The course aims at providing a survey of the XVA universe from the triple angle of finance (wealth transfers), stochastic analysis (enlargement of filtration and backward SDE features), and computations (nested Monte Carlo vs. deep learning regression schemes).

Organisation générale et modalités pédagogiques

Beamer slides course, tutorials in python / tensorflow.

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
<u>Approximations de processus</u>	2	Semestre 2	21								



Approximations de processus

ECTS : 2

Semestre calendaire : Semestre 2

Détail du volume horaire

Cours magistraux : 21

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

Stochastic calculus and Numerical Finance from the first semester

Programme / plan / contenus

- Discretization of Brownian EDS: strong error and weak error
- Approximation of standard exotic derivatives: barrier options, lookbacks, Asian derivatives
- Integration by parts formula and application to the calculation of Greeks
- Non-asymptotic concentration bounds in the Monte Carlo algorithm

Objectifs d'apprentissage

These lectures aim at providing the theoretical basis of the fundamental numerical stochastic analysis techniques that are commonly used in a financial environment.

We will focus on strong and weak error for Brownian SDEs, then address the error associated with the pricing of "usual" exotic derivatives: Barrier/Lookback/Asian options.

We will as well present, through the integration by parts formula, some related applications to the computation of the Greeks.

We will eventually focus on non-asymptotic control bounds for the Monte-Carlo algorithm which is a key tool of all the previously described procedures.

Some additional ouvertures can be related to the convergence analysis of stochastic algorithms of Robbins-Monro type (which can be used in the VaR computation or to the approximation of SDEs with rough coefficients).

Organisation générale et modalités pédagogiques

4 séances de cours de 3H et 3 séance de TP de

Bibliographie

UEs obligatoires

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
Stage professionnel	15	Semestre 2									



Stage professionnel

ECTS : 15

Semestre calendaire : Semestre 2

Langue d'enseignement

Anglais

Enseignement à distance

non

Modalités pédagogiques particulières

Pour le suivi des stages, l'UEVE prendra en charge 56

HETD (4x14 HETD). Le suivi des élèves bicursus

ENSIIE est à la charge de l'ENSIIE.

Nature de l'évaluation

Evaluation Continue non Intégrale

[Préparation au
TOEIC](#)

2

Semestre 2

25

Préparation au TOEIC

ECTS : 2

Semestre calendaire : Semestre 2

Détail du volume horaire

Travaux dirigés : 25

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

Minimum level required : B1 + / B2 (Cadre Européen Commun de Référence)

Programme / plan / contenus

In class you will train for the test by revising grammar rules, learning vocabulary and improving your reading and listening skills. Full tests will be regularly organised and corrected.

Organisation générale et modalités pédagogiques

Weekly 3 hour tutorials from January to March

Assessment : end of semester practise test in class For further information on the official test, go to <https://www.etsglobal.org/Global/Eng>.

Bibliographie

Toeic Practice Exams by Lin Lougheed (Barron's)

Préparation au Nouveau Toeic by Lin Lougheed (Pearson/Longman)

Nature de l'évaluation

Evaluation Continue non Intégrale

UEs obligatoires

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
Projet informatique	3	Semestre 1	2	10							

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
■											

Projet informatique

ECTS : 3

Semestre calendaire : Semestre 1

Détail du volume horaire

Cours magistraux : 2

Travaux dirigés : 10

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

C++ and VBA programming at the level of the “Programming” course, numerical finance at the level of the “Pricing and calibration methods in finance” course.

Programme / plan / contenus

IT project in C++ interfaced in excel/VBA on quantitative finance topics.

Objectifs d'apprentissage

Students will have to work on a programming project in quantitative finance in a team of two.

Organisation générale et modalités pédagogiques

Projects in teams of two students.

Modalités pédagogiques particulières

L'UEVE prend en charge 6,5 HETD, et le reste l'ENSIIE.

Nature de l'évaluation

Evaluation Continue non Intégrale

[Méthodes](#)

[numériques de](#)

[pricing et](#)

[calibration de](#)

[modèles](#)

6

Semestre 1 42

Méthodes numériques de pricing et calibration de modèles

ECTS : 6

Semestre calendaire : Semestre 1

Détail du volume horaire

Cours magistraux : 42

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

Probabilities at a good master 1 level, discrete and continuous time stochastic processes, Derivative products and contracts in Finance and programming with Python at a good master 1 level.

Programme / plan / contenus

I Stochastic analysis prerequisites.

II Monte Carlo methods and variance reduction techniques.

III Hedging financial options.

IV Advanced computation of Greeks.

V Advanced numerical methods for pricing exotic and path dependent of options .

VI Analysis of discretization schemes for stochastic differential equations.

VII Model calibration techniques.

Objectifs d'apprentissage

The aim of this course is to introduce advanced numerical methods needed for quantitative work in finance. To this avail, the course will provide a detailed study for calibrating models, pricing and hedging financial options.

Organisation générale et modalités pédagogiques

42 hours of lectures

Blackboard course, homework coding with Python

Modalités pédagogiques particulières

L'UEVE prend en charge 31,5 HETD, le reste est à la charge de l'ENSIIE.

Bibliographie

Mainly:

Lamberton, D. and Lapeyre P., Introduction to Stochastic

UEs optionnelles

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
Deep learning	3	Semestre 1	21								

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
■											

Deep learning

ECTS : 3

Semestre calendaire : Semestre 1

Détail du volume horaire

Cours magistraux : 21

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

probability, linear regression, penalized regression,
python

FINANCIAL ECONOMETRICS: probability, stochastic
processes, time series

Programme / plan / contenus

The course starts with a quick reminder of the basics of machine learning, mainly focused on introducing the Perceptron and multi-layer Perceptron algorithms. We will then focus on the Multi-layer perceptron, the backpropagation learning algorithm, the different activation functions and their benefits, and the advantages of regularizations. Finally we will present and apply recurrent neural networks as well as convolutional neural networks.

To follow this course, you will need to bring your own computer and have installed the following material:
<https://github.com/brajard/nn/blob/master/INSTALL.md>

Objectifs d'apprentissage

Deep learning structures have been at the source of the recent data science revolution. In this course we will learn the basic architectures that allow performing deep learning analysis of data both for classification and regression problems

Organisation générale et modalités pédagogiques

Continuous monitoring and presentation of articles

Bibliographie

- <http://www.deeplearningbook.org/> , by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
- The Elements of Statistical Learning, T. Hastié, R. Tibshirani, J. Friedman.
- Machine learning, a probabilistic perspective, K.P. Murphy

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
Programmation informatique	6	Semestre 1	18	24							
■											

Programmation informatique

ECTS : 6

Semestre calendaire : Semestre 1

Détail du volume horaire

Cours magistraux : 18

Travaux dirigés : 24

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

C language, additional types (boolean, reference), additional features of functions : default value of arguments and overloading function arguments of type reference or const reference namespaces, exceptions

Programme / plan / contenus

C++: I) Object model declaration of a class definition of a class definition of methods (inline and outside the class) this pointer static members const method II) Encapsulation III) constructor, copy constructor and destructor IV) overloading operator internal operator (incremental operators, brackets operators) external operators (arithmetic operators, stream operators) V) Friend functions and classes friend functions friend classes VI) Inheritance single inheritance multiple inheritance composition or inheritance ? VII) Dynamic allocation of memory new and delete which methods must be overloaded ? VIII) Templates template declaration template function template class template instantiation

Crash course on VBA.

Modalités pédagogiques particulières

L'UEVE prend en charge 27 HETD, l'ENSIIE: 24 HETD

Nature de l'évaluation

Evaluation Continue non Intégrale

Modèles de taux d'intérêt	3	Semestre 1	21
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Modèles de taux d'intérêt

ECTS : 3

Semestre calendaire : Semestre 1

Détail du volume horaire

Cours magistraux : 21

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

INTEREST RATE MODELING: probability, discrete mathematical finance, stochastic process, stochastic calculus.

DEEP LEARNING: probability, linear regression, penalized regression, python

FINANCIAL ECONOMETRICS: probability, stochastic processes, time series

Programme / plan / contenus

- Intro to Interest Rates
- Interest Rates Derivatives
- Spot Rate Models
- HW and CIR Models
- HJM and MLM Models
- MLM Models and Review
- Project presentation and assessment

Objectifs d'apprentissage

We consider the classical short term interest rate models (Vasicek, Hull-White, Cox-Ingersoll-Ross), the HJM approach, and the Libor market model. The practical part, is focused on the calibration of interest rate models to market data.

Organisation générale et modalités pédagogiques

21 hours of lectures

Bibliographie

An Elementary Introduction to Stochastic Interest Rate Modeling by Nicolas Privault

Interest Rate Modeling - Theory and Practice by Lixin Wu

Term-Structure Models by Damir Filipović Interest Rate Models - Theory and Practice

by Damiano Brigo and Fabio Mercurio

Lecture notes of Tomasz Bielecki, Monique Jeanblanc

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
<u>Marchés financiers et finance actuarielle</u>	3	Semestre 1	14	6.5							

Marchés financiers et finance actuarielle

ECTS : 3

Semestre calendaire : Semestre 1

Détail du volume horaire

Cours magistraux : 14

Travaux dirigés : 6.5

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

Course M1 Finance or Financial Mathematics or equivalent

Programme / plan / contenus

1. Hedging interest Rate Risk -With duration -Beyond duration 2)Swaps, Forwards and Futures
Description, Different Uses and Pricing
2. Plain Vanilla Options Option description, strategies and pricing (CRR & Black Scholes models)
3. Introduction to Structured Products and Investment Portfolio Strategies.

Objectifs d'apprentissage

he purpose of this lesson is to train students in the key issues of financial markets (arbitrage, hedging, and speculation) and familiarize them with basic financial instruments (interest rate hedging, swaps, forwards and futures, and options).

Modalités pédagogiques particulières

Ce cours est dupliqué en anglais (à l'UEVE, pris en charge par l'UEVE) et en français à l'ENSIIE (pris en charge par l'ENSIIE).

Bibliographie

L. Martellini, P. Priaulet et S. Priaulet, «Fixed-Income Securities: Valuation, Risk Management and Portfolio Strategies», Wiley, 2003.

Nature de l'évaluation

Evaluation Continue non Intégrale

[Machine learning](#) 6 Semestre 1 21 21

Machine learning

ECTS : 6

Semestre calendaire : Semestre 1

Détail du volume horaire

Cours magistraux : 21

Travaux dirigés : 21

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

Generalized linear models. Linear models with L1 or L2 penalization (Lasso, ridge).

Programme / plan / contenus

parametric models (bayes, ADL, QDL,...), non-parametric models (KNN, decision trees,...), ensemble methods (bagging, random forest, boosting). Dimension reduction methods (functional PCA, Gaussian mixtures, Spectral clustering, Kmeans,...). Performance metrics. ROC curves.

Objectifs d'apprentissage

This course presents theoretical foundations as well as practical application of machine learning models commonly used in regression and supervised classification. Dimension reduction and quantification methods are also studied.

Organisation générale et modalités pédagogiques

12 sessions of 3h30 each divided into lessons or practical work as needed.

Bibliographie

- Hastié, T., Tibshirani, R., Friedman, J. Elements of statistical learning. Springer, 2009.
- Murphy, K. Machine learning: a probabilistic perspective. MIT press, 2012

Nature de l'évaluation

Evaluation Continue non Intégrale

[Calcul](#)
[Stochastique](#)

6

Semestre 1 21

21

Calcul Stochastique

ECTS : 6

Semestre calendaire : Semestre 1

Détail du volume horaire

Cours magistraux : 21

Travaux dirigés : 21

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

he prerequisites are undergraduate probability (Markov chains, discrete time martingales, different convergence notions in probability).

Programme / plan / contenus

We focus on continuous processes through the study of Brownian motion, Itô's formula, Brownian driven Stochastic Differential Equations (SDEs), their correspondence with some appropriate Partial Differential Equations (PDEs). We will also investigate some associated strategies of dynamic/static pricing and hedging of options.

Here are the following key-points of the course.

- Preliminary results on Gaussian vectors
- Characterizations of Brownian motion (as a Gaussian process or as a process with stationary independent Gaussian increments)
- Construction of Brownian motion through the approach of Paul Lévy.
- Itô processes and Itô's formula.
- SDEs and some associated Parabolic PDEs : the Feynman-Kac representation formula and Applications to finance
- The Girsanov theorem.

Objectifs d'apprentissage

The purpose of these lectures is to provide the mathematical background to apprehend a wide class of models appearing in finance.

Organisation générale et modalités pédagogiques

42h of lectures

Bibliographie

Some possible companion books to the lectures are the

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
<u>Econométrie financière</u>	3	Semestre 1	15	10							

Econométrie financière

ECTS : 3

Semestre calendaire : Semestre 1

Détail du volume horaire

Cours magistraux : 15

Travaux dirigés : 10

Projet tutoré 10

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

probability, stochastic processes, time series

Programme / plan / contenus

In this course, we will study time series models related to financial data. We are specifically interested in estimation problems for these models.

Course program :

- Short recap on time series. Basic empirical facts of financial time series.
- GARCH models : existence, properties, estimation of parameters (pseudo-likelihood estimator), volatility forecast. VaR computation, pricing with GARCH, connection with the high frequency sampling of a stochastic volatility model.
- Duration models and trading time modeling (Autoregressive Conditional Duration models, Lo and MacKinlay model).
- Volatility estimation with high frequency data.

Bibliographie

[1] Analysis of Financial Time Series (Anglais) Relié – 10 septembre 2010 de Ruey S. Tsay

[2] Statistics of Financial Markets: An Introduction (2015) by Jürgen Franke (Author), Wolfgang Karl Härdle (Author), Christian Matthias Hafner (Author)

[3] Time Series: Time Series: Theory and Methods (Springer Series in Statistics) (Anglais) Broché – 28 avril 2009 Peter J. Brockwell

[4] Lecture on "The econometrics of high frequency data" by Per Mykland and Lan Zhang,
<http://tiger.uic.edu/~lanzhang/LaManga022209.pdf>

Nature de l'évaluation

Evaluation Continue non Intégrale

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
<u>Finance de l'assurance</u>	3	Semestre 1	36								

Finance de l'assurance

ECTS : 3

Semestre calendaire : Semestre 1

Détail du volume horaire

Cours magistraux : 36

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

FINANCE OF INSURANCE

Course M1 Finance or Financial Mathematics or equivalent

FINANCIAL MARKETS AND ACTUARIAL FINANCE:

None

Programme / plan / contenus

It provides methods regarding how to price traditional insurance products (Life and Death Insurance, Fixed Annuities, etc.) and more advanced insurance products (e.g. CPPI, Variable Annuities). The course also presents some aspects of the Asset and Liability Management of an Insurance company and how to mitigate the risks inherent to insurance business.

Objectifs d'apprentissage

The course is an introduction to the financial aspects of insurance companies

Organisation générale et modalités pédagogiques

This course contains 12 lectures of 3 hours and is mainly taught by a team of professionals from AXA.

Bibliographie

FINANCE OF INSURANCE:

M. FROMENTEAU & P. PETAUTON, Théorie et pratique de l'assurance vie (Dunod)

A. TOSETI et al., Assurance, Comptabilité, Réglementation, Actuariat (Economica)

J. HULL, Options, Futures and Other Derivatives (Pearson)

D. BRIGO & F. MERCURIO, Interest Rate models – Theory and Practice (Springer)

Matières	ECTS	Semestre	Cours	TD	TP	Cours- TD	Cours- TP	TD- TP	A distance	Projet	Tutorat
Gestion des risques	6	Semestre 1	36	15							
■											

Gestion des risques

ECTS : 6

Semestre calendaire : Semestre 1

Détail du volume horaire

Cours magistraux : 36

Travaux dirigés : 15

Langue d'enseignement

Anglais

Enseignement à distance

non

Prérequis

Course M1 Finance or Financial Mathematics or equivalent

Programme / plan / contenus

Market Risk Credit Risk Counterparty Credit Risk and Collateral Risk Operational Risk Liquidity Risk Asset Liability Management Risk Model Risk Copulas and Dependence Modeling Extreme Value Theory Stress Testing and Scenario Analysis Credit Scoring Models.

Objectifs d'apprentissage

The objectives of this course is to give an advanced knowledge in risk management and financial regulations.

Bibliographie

Roncalli, T. (2020), Handbook of Financial Risk Management, Chapman & Hall/CRC Financial Mathematical Series, 1400 pages, forthcoming. Roncalli, T. (2020), Handbook of Financial Risk Management - Companion Book (Solutions of Exercises), Chapman & Hall/CRC Financial Mathematical Series, 410 pages, forthcoming, available at <http://www.thierry-roncalli.com/download/frm-companion.pdf>.

Nature de l'évaluation

Evaluation Continue non Intégrale

Lieu(x) d'enseignement

EVRY

Contact(s)

- **Ahmed Kebaier**

PR

Liens

[Co-habilitation avec l'ENSIIE](#)

[Emploi du temps 2025/2026](#)

[La formation en vidéo](#)

<http://www.universite-paris-saclay.fr/formation/master/mathematiques-et-applications/m2-finance-quantitative>