Polytechnic Institute of New York University

[Finance and Risk Engineering]

Course Outline [FR7851] [Interest Rates Derivatives and Risk Management]

[Semester] [Year]

Professor Frederic Siboulet

Monday 18:00 EST ; [Building], [Room #]

To contact professor: fsiboulet@nyu.edu
[Building], [Room #]
Phone:
Office hours: by appointment

Course Pre-requisites

Course Description The course gives a high level understanding of fixed income and interest rates derivatives instruments, their pricing and risk under deterministic and stochastic conditions

Course Objectives

- Pricing of cash and derivatives for fixed income and interest rates
- Nuance between equity and interest-rate pricing with market price of risk (or risk premium)
- Introduction to single, dual and multi factor models
- Spot and forward rates
- Deterministic and stochastic frameworks
- Application of trees, finite difference methods, stochastic differential equations and martingale, with change of measure and change of numeraire

Course Structure

- Structured presentations and class discussion in and around the presentation flow

Readings

The required text for the course is:

- Brigo and Mercurio, Interest Rates Models Theory and Practgice, Springer Finance

An optional and recommended text is:

- Paul Wilmott on Quantitative Finance 3 Volume Set (2nd Edition)
- Paul Wilmott, Frequently Asked Questions in Quantitative Finance (Wiley 2009)

Course requirements

- Class presentation provided ahead of the class, brief reading recommended
- Three or four homework assignment in group (50%)
- Final individual assignment (50%)
- Assignment include
    - team work,
    - MS-Word/Latex/MathType report writing
    - Limited and easy programing (recommended Matlab or Mathematica, or any other student preference)

Course Content

Focus on interest derivatives, and draw the parallel between several mathematical and probability methods for single and multi-factor interest rates models:

- Introduction to rates (spot, forward, compounded, instantaneous) and families of fixed income and interest rates instruments). Dual curve discounting with OIS
- Calculus methods (PDE, Kolmogorov equations, binomial and trinomial trees, martingales and changes of measures, Radon Nikodym derivatives and Girsanov theorem, change of numeraire).
- Compare and contrast the stochastic calculus applied to traded instruments (e.g. stocks or forex) with that on non-traded instruments (interest rates)
- Complete and incomplete markets
- Spot rate models, single and multi-factors: Vasicek, Cox Ingersoll Ross, Ho Lee, Hull an White I and II
- Forward market models: HJM and BGM
- Bond pricing equations, derivatives pricing, risk sensitivities, market price of risk (aka Sharpe ratio for non-trade underlying)