**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 #]

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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)