MATH4511 Quantitative Methods for Fixed Income Derivatives

Course Outline- Fall 2023

1. **Instructor(s)**

   Name: Lixin Wu

   Contact Details: 2358-7435/malwu

2. **Teaching Assistant(s)**

   Name: Xia Wencan

   Contact Details: wxiaab@connect.ust.hk

3. **Meeting Time and Venue**

   Lectures:

   Date/Time: Tues, Thur, Fri., 1330 - 1450

   Venue: G009A, CYT Bldg

   Tutorials:

   Date, Time/Venue:

   T1A, Wed 05:00PM - 05:50PM, Rm 6602, Lift 31-32

   T1B, Mon 06:00PM - 06:50PM, Rm 2463, Lift 25-26

4. **Course Description**

   Credit Points: 3

   Pre-requisite: Multivariable calculus and probability

   Exclusion: NIL

   Brief Information/synopsis:

   Bond, bond markets and interest-rate derivatives markets. Yields, forward rate and swap rates. Yield-based risk management and regression-based hedging. Mortgage mathematics. Binomial models for equity and fixed-income derivatives. Arbitrage pricing and risk-neutral valuation principle. Lognormal models and Black formula for caps and swaptions. Selected securities (Repos and Total Return Swaps).

5. Intended Learning Outcomes

Upon successful completion of this course, students should be able to:

No.	ILOs
1	Understand the fixed-income markets and popular securities
2	Know bond mathematics and related risk management
3	Understand arbitrage pricing principle for derivatives pricing.
4	Be able to build interest-rate trees and price interest-rate derivatives.

6. Assessment Scheme

a. Examination duration: 3 hrs

b. Percentage of coursework, examination, etc.:

Assessment	Assessing Course ILOs
20% by coursework	1, 2, 3, 4
30% by midterm exam	1, 2, 3, 4
50% by final exam	1, 2, 3, 4

c. The grading is assigned based on students' performance in assessment tasks/activities.

7. Student Learning Resources

Lecture notes by the instructor plus recommended reading.

8. Teaching and Learning Activities

Scheduled activities: 3 hrs (lecture)

9. Course Schedule

Keyword Syllabus:

- Introduction to global financial markets
- Bonds, bond markets and interest-rate derivatives markets
- Yields, forward rates and swap rates
- Mortgage mathematics
- Yield-based risk management and regression-based hedging
- Binomial models for equity and fixed-income derivatives
- Arbitrage pricing and the risk-neutral valuation principle
- Brownian motions and the Ito's Lemma
- Black-Scholes model and Black-Scholes formula
- Black formula for caps and swaptions
- Repo, total return swaps