MATH4511 Quantitative Methods for Fixed Income Derivatives
Course Syllabus Fall 2025

Course Title: Quantitative Methods for Fixed Income Derivatives

Course Code: MATH 4511

No. of Credits: 3

Prerequisites: (MATH 2011 / MATH 2023) AND (MATH 2111 / MATH 2121 / MATH 2131 / MATH 2350) AND (IEDA 2520 AND IEDA 2540 / ISOM 2500 / LIFS 3150 / MATH 2411) AND (FINA 2203 / FINA 2303)

Name: Lixin Wu

Email: malwu@ust.hk

Office Hours: Walk in or by appointment, Rm 3427

Course Description

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. Eurodollar futures. Lognormal models and Black formula for caps and swaptions. Selected securities (Repos and Total Return Swaps).

Intended Learning Outcomes (ILOs)

By the end of this course, students should be able to:

1. Understand the fixed-income markets and popular securities
2. Master bond mathematics and related risk management methodologies
3. Understand arbitrage pricing principle for derivatives pricing.
4. Be able to apply the Black formula to interest-rate derivatives.

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)	Due date
Homework	20%	weekly
Mid-Term	30%	31/10/2025
Final examination	50%	

* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Homework	ILO1, ILO2, ILO3, ILO4	[Example: This task assesses students' ability to explain and apply XX concepts (ILO 1), evaluate their implications (ILO 2), critically analyze their role in society (ILO 3), and synthesize a well-argued solution (ILO 4).]
Midterm Exam	ILO1, ILO2, ILO3, ILO4	[Example: The presentation and reflection assess students' ability to critically evaluate XX (ILO 3) and analyze XX (ILO 4), demonstrating higher-order thinking skills of analysis and evaluation.]
Final Exam	ILO1, ILO2, ILO3, ILO4	

Grading Rubrics

[Detailed rubrics for each assignment will be provided. These rubrics clearly outline the criteria used for evaluation. Students can refer to these rubrics to understand how their work will be assessed.]

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Deliver excellent performance in homework, midterm and final exam. Through the course work, demonstrate a correct and comprehensive understanding of the theories taught.
B	Good Performance	Have a good understanding of the theories. Have a good performance on most course work.
C	Satisfactory Performance	Have an adequate understanding of the theories. Have a fair performance in course work.
D	Marginal Pass	Have acquired the basic concepts of the theories. Have delivered a performance in course work to achieve a basic understanding of the theories.
F	Fail	Have delivered a very poor overall performance in course work. Demonstrate the failure to understand the basic concepts of the theories. Considered necessary to retake the same course, if possible.

Course AI Policy

Students are encouraged to finish homework independently, using large linguistic models (LLM) only for helps. But AI tools are not allowed for exams.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via offline tutorial sessions. Students are encouraged to see instructor and tutors for questions or clarification of scoring/grading. A paper checking session will be offered after final the exam.

Resubmission Policy

With justifications, students can be grated late submission of homework, or make-up exam for midterm and final.

Required Texts and Materials

Lecture notes provided by the instructor plus recommended reading.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

[Optional] Additional Resources

Wu, L. (2024). Interest Rate Modeling: Theory and Practice, the 3rd edition, Chapman Hall/CRC.
Tuckman, Bruce (2002). Fixed Income Securities: Tools for Today's Markets, 2nd ed. John Wiley & Sons, Inc (ISBN-10: 0471063177.
Hull, John (2014). Options, Futures, and Other Derivatives, 12th ed. Prentice Hall (ISBN-10: 013345631).
McDonald, Robert, L. (2014). Derivatives Markets, 3rd ed. Pearson International Edition (ISBN 10: 1-292-02125-X).
Fabozzi, Frank J. (1997). Fixed income mathematics: analytical & statistical techniques, 3rd ed., McGraw-Hill (ISBN: 0-7863-1121-5).
Fabozzi, Frank J. (2003). Bond markets, analysis and strategies, 5th ed. Pearson/Prentice Hall (ISBN: 0-13-049782-7).