

The Hong Kong University of Science and Technology

UG Course Syllabus

Introduction to Financial Engineering

IEDA 3330

3 Credits

Pre-requisite: CIVL 2160 OR ELEC 2600 OR (IEDA 2520 AND IEDA 2540) OR ISOM 2500 OR MATH 2411 OR MATH 2421 OR MATH 2431

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Course Description

This course provides a basic introduction to financial engineering. It covers the structure of financial markets, financial institutions, and financial instruments, as well as basic quantitative models used in finance. Major topics include fixed income securities (i.e., theory of interest, bond pricing, term structure), the classic mean-variance analysis and equilibrium asset pricing theories (i.e., capital asset pricing model, factor model, arbitrage pricing theory), basic option theory, and basic FinTech topics such as AI in finance, robo-advising, cryptocurrencies, blockchain, and green finance.

The course includes regular lectures and tutorial sessions. In lectures, students will learn theoretical models and quantitative methods. In tutorial sessions, the teaching assistant will provide tutorial instruction and answer questions from lectures and homework. The course is intended to equip students with foundational knowledge and quantitative skills for financial engineering.

Intended Learning Outcomes (ILOs)

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

1. Explain the basic structure of the financial system, including financial markets, financial institutions, and financial instruments.
2. Apply basic quantitative models to analyze fixed income securities, including the theory of interest, bond pricing, and term structure.
3. Explain and apply basic asset pricing frameworks, including mean-variance analysis, the capital asset pricing model, factor models, and arbitrage pricing theory.
4. Demonstrate foundational understanding of derivative pricing, risk management, and selected FinTech concepts.
5. Develop basic quantitative and analytical skills relevant to financial engineering.

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

There are about four homework assignments. Homework is usually posted on Wednesday. For paper homework, submission is due in two weeks and should be submitted in class or online. There will also be two in-class examinations (which may be taken online if necessary): a midterm exam and a final exam. A group project and class participation also contribute to the final grade.

Summary Table

Assessment Task	Contribution to Overall Course grade (%)	Due date
Participation	10%	Throughout semester
Homework	20%	Various dates
Midterm Exam	20%	To be announced
Final Exam	25%	During the Final Examination Period
Group Project	25%	To be announced

Mapping of Course ILOs to Assessment Tasks

Assessed Task	Mapped ILOs	Explanation
Homework	ILO 2, ILO 3, ILO 5	Homework assesses students' ability to apply quantitative methods to fixed income securities and asset pricing topics, and to develop analytical problem-solving skills in financial engineering contexts.
Midterm Exam	ILO 1, ILO 2, ILO 3	The midterm exam assesses students' understanding of foundational concepts in financial markets, institutions, instruments, fixed income securities, mean-variance framework, and asset pricing models covered in the first part of the course.
Final Exam	ILO 3, ILO 4, ILO 5	The final exam assesses students' understanding and application of later course topics, including derivative theory, risk management, and FinTech concepts, as well as their overall analytical ability.
Group Project	ILO 4, ILO 5	The group project assesses students' ability to explore financial engineering topics collaboratively, apply course knowledge, and communicate their understanding effectively.

Grading Rubrics

Midterm and Final Exams Student Rubrics

Criteria	Excellent	Good	Satisfactory	Marginal	Fail	Mapping to Course ILOs
Understanding of Core Concepts	Demonstrates excellent understanding of the key concepts, theories, and methods assessed in the examination.	Demonstrates good understanding of most key concepts, theories, and methods assessed in the examination.	Demonstrates satisfactory understanding of the essential concepts and methods assessed in the examination.	Demonstrates limited understanding of the examination material, with noticeable gaps in knowledge.	Demonstrates insufficient understanding of the core concepts and methods assessed in the examination.	ILO 1
Application and Integration	Applies, integrates, and adapts course concepts, methods, and techniques effectively to solve problems and respond to examination questions.	Applies and integrates relevant concepts and methods correctly in most cases, with only minor weaknesses.	Applies basic concepts and methods with some success, though responses may lack depth, consistency, or effective integration.	Shows limited ability to apply and integrate concepts and methods appropriately in examination responses.	Is unable to apply or integrate course concepts and methods effectively in examination responses.	ILO 2, ILO 4
Accuracy and Reasoning	Responses are accurate, logically structured, and well supported with clear and convincing reasoning.	Responses are mostly accurate, reasonably well organized, and supported by sound reasoning.	Responses show basic accuracy and acceptable reasoning, though some explanations may be incomplete, unclear, or insufficiently supported.	Responses contain substantial errors, weak reasoning, or insufficient justification.	Responses are largely incorrect, unsupported, or demonstrate a lack of logical reasoning.	ILO 4

Group Project Student Rubrics

Criteria	Excellent	Good	Satisfactory	Marginal	Fail	Mapping to Course ILOs
Problem Definition / Project Scope	Clearly defines the project problem, objectives, constraints, and relevance. Demonstrates strong understanding of the context.	Defines the project clearly with minor omissions in context or scope.	Defines the project adequately but lacks precision or depth.	Project definition is vague, incomplete, or somewhat inaccurate.	Project is not clearly defined or misunderstood.	ILO 2, ILO 4
Application of Course Knowledge	Applies course concepts, methods, and tools appropriately and effectively to the project.	Applies relevant course knowledge well with minor weaknesses.	Applies basic course knowledge with some limitations.	Limited or inconsistent application of course knowledge.	Fails to apply relevant course knowledge meaningfully.	ILO 2, ILO 3
Analysis and Interpretation	Presents thoughtful analysis, interprets findings logically, and supports conclusions with evidence.	Provides clear analysis and generally sound interpretation.	Provides basic analysis with some support for conclusions.	Analysis is weak, incomplete, or poorly supported.	Little or no analysis is evident.	ILO 3, ILO 4

Final Grade Descriptors

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive grasp of financial systems, quantitative models, asset pricing theories, derivative theory, and FinTech concepts. Applies analytical and quantitative methods accurately and insightfully, and shows strong problem-solving ability in financial engineering contexts.
B	Good Performance	Shows good knowledge and understanding of the main subject matter, including financial markets, fixed income analysis, asset pricing, and derivatives. Demonstrates competence in quantitative problem-solving and the ability to analyze financial engineering issues effectively.
C	Satisfactory Performance	Possesses adequate knowledge of core financial engineering concepts and demonstrates basic competence in dealing with familiar quantitative and conceptual problems. Shows some ability for analysis and application of course material.
D	Marginal Pass	Has threshold knowledge of the core subject matter and limited ability to apply basic financial engineering concepts and methods. Demonstrates minimal but sufficient understanding to meet the basic course requirements.
F	Fail	Demonstrates insufficient understanding of financial engineering concepts and lacks the necessary analytical and quantitative problem-solving skills. Does not meet the threshold learning requirements of the course.

Course AI Policy

Students may use online resources and digital tools for learning support, subject to the instructor's guidance and the university's academic integrity requirements. Any use of generative artificial intelligence tools in assessed work must comply with course requirements and academic honesty standards.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated within two weeks of submission or due date, where applicable. Feedback on assignments will include strengths and areas for improvement. Students who have further questions about feedback or marks should consult the instructor/TA within five working days after the feedback is received.

Students are encouraged to ask questions in class. Tutorial sessions also provide opportunities to seek clarification on lecture materials and homework.

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.

For homework, discussing with classmates is allowed; copying without thinking and digesting is not. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

Additional Resources

Class Time and Location

- **Lectures:** Tuesday and Thursday, 9:00 pm–10:20 pm, Room LG3008
- **Tutorial:** Thursday, 6:00 pm–6:50 pm, Room G009B

Teaching Assistant

- **Name:** Mr. Wu Weinan
- **Email:** wwubx@connect.ust.hk

Tentative Course Schedule

- Week 1: Introduction
- Week 2: Financial Markets, Institutions, and Instruments
- Weeks 3–4: Fixed Income Securities: theory of interest, bond price, and term structure
- Weeks 5–6: Mean-variance analysis
- Weeks 7–8: Capital asset pricing model, factor model, and arbitrage pricing theory
- Weeks 9–10: Basic derivative theory and risk management
- Week 11: Risk aversion, expected utility, and portfolio decisions
- Weeks 12–13: Basic FinTech theory: AI in finance, robo-advising, cryptocurrencies and blockchain, green finance, etc.

References

- Luenberger, D. G., *Investment Science*.
- Hull, John, *Options, Futures, and Other Derivatives*.
- Mishkin, Frederic S., and Stanley G. Eakins, *Financial Markets and Institutions*.

Learning Resources

- Google
- Stack Overflow
- Office hour support

Teaching Philosophy

- Financial engineering requires a reasonably solid background in mathematics, programming, and financial intuition.
- Students are encouraged to ask questions in class. No questions are stupid.

- Financial engineering is a broad topic that can span multiple courses. This course provides a basic introduction to the field.
- The more curious students are, and the more they read and ask questions after class, the more they will learn.