

Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): MATH3740 Derivatives (3,3,0)

Course Aims: This course introduces the theory and practice of pricing and hedging of derivative securities. It covers equity and index, foreign currency, commodity, and interest-rate derivatives. Basic mathematical concepts and the institutional structure of derivative markets are discussed.

Prerequisite: MATH1112 Mathematical Analysis II, STAT1131 Statistical Methods and Theory I

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Course Intended Learning Outcomes (CILOs):

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

No.	Course Intended Learning Outcomes (CILOs)
1	Analyse price futures/forward contracts and options contracts.
2	Use information from option and futures markets to form their market views.
3	Use arbitrage arguments in pricing derivative securities.
4	Use arbitrage arguments to analyse the price dynamics of derivative securities.
5	Devise hedging, trading, and arbitrage strategies with futures, options, and cash positions to reveal specific market views.

Teaching & Learning Activities (TLAs)

CILO	TLAs will include the following:
1-5	Lectures with rigorous mathematical discussions and concrete examples. The lecturer will constantly ask questions in class to make sure that the majority of students are following the teaching materials.
1-5	Assignments to monitor both students' learning and mastering of the taught materials. In addition, common mistakes will also be addressed and analyzed.

Assessment:

No.	Assessment Methods	Weighting	CILO Addressed	Remarks
1	Continuous Assessment	30%	1-5	Assessments are designed to measure how well the students' recognizing of the theory and practice of pricing and hedging of derivative securities. The test is conducted to monitor the students' recognizing of the theory, techniques and skills taught in the class. This may involve, but not limited to, in class discussions of rigorous technical problems and their solutions.
2	Final Examination	70%	1-5	Final Examination questions are designed to see how far students have achieved their intended learning outcomes. Students should have a thorough recognizing of the knowledge and apply them correctly in different context to do well in the exam.

Course Intended Learning Outcomes and Weighting:

Content	CILO No.	Teaching (in hours)
1. Introduction Returns, volatility and correlation	1	2
2. Time value of money	1	2
3. Value at risk FX forwards and futures	1,2,5	2
4. Stock index futures Commodity futures	1,2,5	3
5. Bond futures (1) Bond futures (2)	1,2,5	3
6. Spread trading Interest rate forwards and futures	1,2,5	3
7. Interest rate swaps Pricing interest rate derivatives	2,3	3
8. Introduction to options	2,3,4	3
9. The Black-Scholes model The generalized Black-Scholes model	2,3,4	5
10. The binomial model The Monte Carlo model	1,2,4,5	7
11. Volatility (1) Volatility (2)	1,2,4,5	5
12. The Greeks (1) The Greeks (2)	1,2,4,5	2
13. Review of forwards, futures and swaps Review of options	1,2,3,4,5	2

Textbook: John Hull, *Options, Futures and Other Derivatives*, 9th edition, Prentice Hall, 2014.

References: Michael Lewis, *Liars Poker*, W. W. Norton & Company, 2010.
Roger Lowenstein, *When Genius Failed: The Rise and Fall of Long-Term Capital Management*, Random House Trade Paperbacks, 2001.
Nicholas Dunbar, *Inventing Money: The Story of Long-Term Capital Management and the Legends Behind It*, Wiley, 2000.

Course Content in Outline:

	<u>Topic</u>	<u>Hours</u>
I.	Introduction Returns, volatility and correlation	2
II.	Time value of money	2
III.	Value at risk FX forwards and futures	2
IV.	Stock index futures Commodity futures	3
V.	Bond futures (1) Bond futures (2)	3
VI.	Spread trading Interest rate forwards and futures	3
VII.	Interest rate swaps Pricing interest rate derivatives	3
VIII.	Introduction to options	3
IX.	The Black-Scholes model The generalized Black-Scholes model	5
X.	The binomial model The Monte Carlo model	7
XI.	Volatility (1) Volatility (2)	5
XII.	The Greeks (1) The Greeks (2)	2
XIII.	Review of forwards, futures and swaps Review of options	2