Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): ORBS7200 Derivatives (3,3,0)

Course Aims: This course introduces computational methods for problems of finance and economic development, including mainly the computation of market indicators and option price.

Prerequisite: No

Prepared by: Luo Dehui

Remark: This course is delivered by staff of HKBU.

Course Intended Learning Outcomes (CILOs):

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

No.	Course Intended Learning Outcomes (CILOs)
1	Describe the operations of various financial derivatives
2	Valuate bonds, forward contracts, and swap contracts using no-arbitrage principle
3	Apply binomial tree method and Black-Scholes models to price plain vanilla options
4	Explain the fundamental principles underlying Black-Scholes models

Teaching & Learning Activities (TLAs):

CILO	TLAs will include the following:
1,2,3,4	Lectures with rigorous mathematical discussions and concrete examples. Lecturer will constantly ask questions in class to make sure that the majority of students are following the teaching materials.
1,2,3,4	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	Assignments	40%	all	Assignments are designed to measure students' understanding of the theory, techniques, and applications of computational finance. The assignments are conducted to monitor the students' understanding 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	60%	all	Final Examination is designed to see how far students have achieved their intended learning outcomes especially in the knowledge domain. Students should have a thorough understanding 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 to Financial Markets	1	3
2. Interest Rates and Bonds	1,2	6
3. Valuation of Forward and Futures	1,2	6
4. Swaps	1,2	3
5. Options Markets	1	6
6. Binomial Tree Method	3,4	6
7. The Black-Scholes Model	3,4	9

References:

1. John C. Hull, Options, *Futures and Other Derivatives Securities,* Prentice-Hall, 3rd edition, 1997.
2. P. Wilmott, S. Howison & J. Dewynne, *The Mathematics of Financial Derivatives*, Cambridge University Press, 1996.
3. M. Pring, *Technical Analysis Explained*, McGraw Hill Book Co., 3rd edition, 1991.

Course Content in Outline:

Topic	Hours
I. Introduction to Financial Market	3

    A. Corporations
    B. Stocks
    C. Futures
    D. Options

II. Interest Rates and Bonds   6
    A. Zero rates
    B. Bond pricing
    C. Treasury zero rates
    D. Forward rates

III. Valuation of Forward and Futures   6
    A. Short selling
    B. Forward price
    C. Valuation of forward contracts
    D. Forward and futures contracts on currencies

IV. Swaps   3
    A. Mechanics of interest rate swaps
    B. Valuation of interest rate swaps
    C. Mechanics of currency swaps
    D. Valuation of currency swaps

V. Options Markets   6
    A. Types of options and option positions
    B. Factors affecting option prices
    C. Bounds for option prices
    D. Put-call parity
    E. Trading strategies

VI. Binomial Tree Method   6
    A. Multi-step binomial tress
    B. No-arbitrage principle
    C. Risk-neutral valuation
    D. American options
    E. Cox-Ross-Rubinstein model

VII. The Black-Scholes Model   9
    A. Continuous-time stochastic processes
    B. Brownian motion and Wiener process
    C. Ito's lemma
    D. Black-Scholes differential equation
    E. Black-Scholes pricing formulas