Title (Units): **COMP 7380 Computational Finance (3,2,1)**

Course Aims: To introduce the principles of computational finance; to discuss financial market mechanics such as options, futures, and other derivatives; to study hedging strategies using futures; to understand trading strategies involving options; to explain option pricing models such as the Black-Scholes-Merton equation and its solution and implementation; to investigate sensitivity factors affecting option prices.

Prerequisite: Postgraduate student standing and basic knowledge in probability, statistics and differential equations

Course Intended Learning Outcomes (CILOs):
Upon successful completion of this course, students should be able to:

No.	Course Intended Learning Outcomes (CILOs)
	Knowledge
1	Understand products in financial markets.
2	Explain financial concepts such as options, futures, and derivatives.
3	Describe pricing models for options, futures, and derivatives.
4	Derive solutions for option pricing models.
	Professional Skill
5	Compute prices for options and futures.
6	Analyze effects of market conditions on option pricing.

Calendar Description: This course is designed to introduce the principles of computational finance. Topics covered include financial market mechanics such as options, futures, and other derivatives, hedging strategies using futures, and trading strategies involving options. Detail explanations of option pricing models such as the Black-Scholes-Merton equation and its solution and implementation will be given. Sensitivity factors affecting option prices will be discussed.

Teaching and Learning Activities (TLAs):

CILOs	TLAs will include the following
1-4	Students will learn the computational finance concepts and techniques via lectures, tutorials, and assignments.
5-6	Students will work on assignments to gain hands-on experience in financial mathematics and option price calculations.

Assessment:

No.	Assessment Methods	Weighting	CILOs to be addressed	Remarks
1	Continuous Assessment	40%	1-6	Continuous assessments are designed to measure how well the students have learned the basic concepts and techniques in the pricing and modeling of options, futures and other derivatives
2	Examination	60%	1-6	Final examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be analysis and skills based to assess the students' ability in computational finance.

Rubrics:

	Excellent (A)	Good (B)	Satisfactory (C)	Fail (F)
Demonstrates an understanding of financial concepts	Demonstrates **thorough** knowledge and understanding of	Demonstrates **sufficient** knowledge and understanding of	Demonstrates **acceptable** knowledge and understanding of	Demonstrates **limited** knowledge and understanding of key concepts and

	key concepts and characteristics in finance, including options, futures, and other derivatives.	key concepts and characteristics in finance, including options, futures, and other derivatives.	key concepts and characteristics in finance, including options, futures, and other derivatives.	characteristics in finance, including options, futures, and other derivatives.
Uses critical and creative thinking skills to analyze pricing models	Uses critical and creative thinking with a **high degree** of effectiveness in analyzing pricing models.	Uses critical and creative thinking with a **considerable degree** of effectiveness in analyzing pricing models.	Uses critical and creative thinking with an **acceptable degree** of effectiveness in analyzing pricing models.	Uses critical and creative thinking with a **limited degree** of effectiveness in analyzing pricing models.
Understands how option prices move in relation to different market factors.	Demonstrates understanding and criticism with a **high degree** of clarity in various sensitivity analysis factors.	Demonstrates understanding and criticism with a **considerable degree** of clarity in various sensitivity analysis factors.	Demonstrates understanding and criticism with an **acceptable degree** of clarity in various sensitivity analysis factors.	Demonstrates understanding and criticism with a **limited degree** of clarity in various sensitivity analysis factors.
Implements solutions for option pricing models	**Correct** program implementation	**Mostly correct** program implementation	**Acceptably correct** program implementation	**No/incorrect** program implementation

Course Intended Learning Outcomes and Weighting:

Content	**CILO No.**
I. Background Mathematics	1-6
II. Options and Futures	1-2
III. Black-Scholes-Merton Model	3-5
IV. Extended Topics	4, 6

References:

J. Hull, Options, Futures, and Other Derivatives, Pearson Hall, 9th Edition, 2014.
Yuh-Dauh Lyuu, Financial Engineering and Computation: Principles, Mathematics, Algorithms, Cambridge University Press, 2002.
Z. Bodie, A. Kane, and A. Marcus, Investments, McGraw Hill, 2013.
E. Elton, M. Gruber, S. Brown, and W. Goetzmann, Modern Portfolio Theory and Investment Analysis, Wiley, 9th Edition, 2014.

Course Content in Outline:

Topic

I. Background Mathematics
- A. Statistics
- B. Differential equations
- C. Computational methods

II. Options and Futures
- A. Introduction to markets, contracts, and traders
- B. Mechanics of futures markets
- C. Hedging strategies using futures
- D. Interest rates
- E. Determination of forward and futures prices
- F. Mechanics of options markets
- G. Properties of stock options
- H. Trading strategies involving options

III. Black-Scholes-Merton Model
   A. Binomial trees
   B. Wiener processes and Ito's Lemma
   C. Black-Scholes-Merton model and differential equation
   D. Sensitivity analysis of options (delta, theta, gamma, and etc.)

IV. Extended Topics (e.g., Volatility, Value at Risk, and etc.)