Title (Units): **COMP7390 Algorithms for Financial Information Systems (3,2,1)**

Course Aims: To introduce financial algorithms in interest rates, term structure, bonds, and bond markets; to discuss financial market mechanics such as stocks, options, and futures; to study basic algorithms of hedging and trading strategies using options and futures; to review techniques in statistics in relation to these topics; to gain hands-on computer experience in solving these problems.

Prerequisite: Postgraduate student standing and basic knowledge in probability and statistics

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

No.	Course Intended Learning Outcomes (CILOs)
	Knowledge
1	Identify products in financial markets.
2	Explain knowledge on interest rates, term structure, bonds, and bond markets.
3	Describe the factors affecting bond volatility.
4	Explain financial concepts such as stocks, options, and futures.
	Professional Skill
5	Perform calculations based on pricing models of options and futures.
6	Execute simple hedging and trading strategies.

Calendar Description: This course is to introduce algorithms in financial markets. Interest rates, term structure, bonds, and bond markets will be studied. Factors affecting bond price volatility will be discussed. In addition, financial market mechanics such as stocks, options, and futures will be covered. Basic algorithms of hedging and trading strategies using options and futures will be examined. Hands-on computer techniques for these calculations will be given.

Teaching and Learning Activities (TLAs):

CILOs	Type of TLA
1-6	Students will learn concepts and skills in financial markets and algorithms in lectures and tutorials.
2-6	Students will work on assignments and examination to enhance their understanding of financial vehicles and algorithms.

Assessment:

No.	Assessment Methods	Weighting	CILOs to be addressed	Description of Assessment Tasks
1	Continuous Assessment	40%	1-6	Continuous assessments are designed to measure how well students have learned the basic concepts and skills of financial algorithms. Two tests (total 24%) will be given. Test 1 will access CILOs 1-3. Test 2 will access CILOs 4-6. A number of assignments (total 16%) will be given to access CILOs 1-6.
2	Examination	60%	1-6	Final Examination questions are designed to evaluate how far students have achieved their intended learning outcomes. Questions will primarily be analysis and skills based to assess the student's ability in the understanding and application of financial vehicles and algorithms.

Assessment Rubrics:

Excellent (A)	• Achieve all CILOs, demonstrating a good mastery of both the theoretical and practical aspects of the knowledge and skills associated with financial vehicles. • Able to develop correct solutions to a lot of problems in bonds, stocks, and financial derivatives. • Able to apply a variety of software skills to solve problems in financial vehicles.
Good (B)	• Achieve most of the six CILOs, demonstrating a good understanding of the knowledge and skills associated with financial vehicles. • Able to develop correct solutions to problems in bonds, stocks, and financial derivatives. • Able to apply selected software skills to solve problems in financial vehicles.
Satisfactory (C)	• Achieve some of the six CILOs, demonstrating a basic level of understanding of the knowledge and skills associated with financial vehicles. • Able to provide acceptable solutions to some problems in bonds, stocks, and financial derivatives. • Able to apply some software skills to solve problems in financial vehicles.
Fail (F)	• Achieve none of the six CILOs, with little understanding of the associated financial vehicles. • Unable to provide solutions to simple problems in bonds, stocks, and financial derivatives. • Unable to apply any software skills to solve problems in financial vehicles.

Course Content and CILOs Mapping:

Content		**CILO No.**
I	Background Mathematics	2-6
II	Interest Rates, Term Structure, Bonds, and Bond Markets	1-3
III	Stocks, Options, and Futures	4-6
IV	Software Packages	2-6

References:

- J. Hull, Options, Futures, and Other Derivatives, Pearson Hall, 9th Edition, 2014.
- Z. Bodie, A. Kane, and A. Marcus, Investments, 10th Edition, McGraw-Hill, 2013.
- Yuh-Dauh Lyuu, Financial Engineering and Computation: Principles, Mathematics, Algorithms, Cambridge University Press, 2002.
- E. Elton, M. Gruber, S. Brown, and W. Goetzmann, Modern Portfolio Theory and Investment Analysis, Wiley, 9th Edition, 2014.

Course Content:

Topic

I. Background Mathematics
   A. Basic financial mathematics
   B. Statistics

II. Interest Rates, Term Structure, Bonds, and Bond Markets
   A. Interest rates
   B. Term structure of interest rates
   C. Bonds and bond markets
   D. Bond price volatility
   E. Managing bond portfolios

III. Stocks, Options, and Futures
   A. Introduction to markets, contracts, and traders
   B. Mechanics of futures markets
   C. Hedging strategies using futures
   D. Determination of forward and futures prices

E. Mechanics of options markets
F. Properties of stock options
G. Trading strategies involving options
H. Introduction to Black-Scholes-Merton Model

IV. Software Packages