MA6628: PROGRAMMING AND COMPUTING IN FINANCIAL ENGINEERING

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Programming and Computing in Financial Engineering

Subject Code
MA - Mathematics
Course Number
6628

Academic Unit
Mathematics (MA)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to
· develop students' comprehensive capability of applying numerical methods to formulate and analyze problems in financial products; and
· explain and evaluate techniques of realizing financial and insurance models through optimal algorithms and computer programming.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe basic issues and framework of computation in finance	20	x		
2	Explain clearly concepts and basic methods of solving partial differential equations.	20	x	x	
3	Implement numerical and computational methods such as finite-difference method, Monte-Carlo simulation, etc. for evaluating more complicated mathematical problems in finance.	20	x	x	
4	Analyze, design and implement solutions using appropriate programming language(s) to assess financial risks and construct financial models in practice	20	x	x	x
5	Apply numerical methods to model financial phenomena and analyze other practical problems	20	x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	teaching	Students will engage in lecture activities about numerical methods to financial models.	1, 2, 3, 4, 5	26 hours in total
2	tutorials	Students will engage in tutorials primarily based on interactive problem solving/ hand-on computer exercises allowing instant feedback.	1, 2, 3, 4, 5	13 hours in total

3	take-home assignments	Students are required to finish take-home assignments which help them implement basic numerical methods of mathematical finance and actuarial science to analyze solutions of problems with programming tools.	1, 2, 3, 4, 5	After class
4	project(s)	Students will consolidate their learning as they produce on report on formulating more sophisticated financial and actuarial problems in a numerical framework with the aid of methods and computing techniques introduced in this course.	5	After class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Test	1, 2, 3	25	25--50%
2	Hand-in assignments	1, 2, 3, 4, 5	25	0 -- 25%
3	Essay	5	50	25--50%

Continuous Assessment (%)

100

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained

Assessment Rubrics (AR)

Assessment Task

1. Test (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Problem solving based on comprehensive understanding

Excellent

(A+, A, A-) Consistently demonstrates a thorough understanding of statistical models and numerical methods for formulating and solving sophisticated financial and actuarial problems

Good

(B+, B, B-) Adequately demonstrates an understanding of statistical models and numerical methods for formulating and solving financial and actuarial problems

Fair

(C+, C, C-) Demonstrates some understanding of statistical models and numerical methods for formulating and solving simple financial and actuarial problems

Marginal

(D) Demonstrates limited understanding of statistical models and numerical methods and can seldom formulate and solve simple financial and actuarial problems

Failure

(F) Demonstrates little understanding of statistical models and numerical methods and can rarely or never formulate and solve simple financial and actuarial problems

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Assessment Task

2. Hand-in assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Problem solving based on comprehensive understanding

Excellent

(A+, A, A-) Consistently demonstrates a thorough understanding of statistical models and numerical methods for formulating and solving sophisticated financial and actuarial problems

Good

(B+, B, B-) Adequately demonstrates an understanding of statistical models and numerical methods for formulating and solving financial and actuarial problems

Fair

(C+, C, C-) Demonstrates some understanding of statistical models and numerical methods for formulating and solving simple financial and actuarial problems

Marginal

(D) Demonstrates limited understanding of statistical models and numerical methods and can seldom formulate and solve simple financial and actuarial problems

Failure

(F) Demonstrates little understanding of statistical models and numerical methods and can rarely or never formulate and solve simple financial and actuarial problems

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Assessment Task

3. Essays (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Creativity based on learning, software usage, and data analysis ability

Excellent

(A+, A, A-) Consistently exhibits a thorough understanding of the financial phenomena and other practical problems in the essays

Good

(B+, B, B-) Sufficiently demonstrates comprehension of the financial phenomena and other practical problems in the essays

Fair

(C+, C, C-) Displays a moderate and intermediate grasp of the the financial phenomena and other practical problems, clearly articulated in the essay

Marginal

(D) Demonstrates some understanding of the financial phenomena and other practical problems in the essays

Failure

(F) Demonstrates little understanding of the financial phenomena and other practical problems in the essays

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Assessment Task

1. Test (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Problem solving based on comprehensive understanding

Excellent

(A+, A, A-) Consistently demonstrates a thorough understanding of statistical models and numerical methods for formulating and solving sophisticated financial and actuarial problems

Good

(B+, B) Adequately demonstrates an understanding of statistical models and numerical methods for formulating and solving financial and actuarial problems

Marginal

(B-, C+, C) Demonstrates limited understanding of statistical models and numerical methods and can seldom formulate and solve simple financial and actuarial problems

Failure

(F) Demonstrates little understanding of statistical models and numerical methods and can rarely or never formulate and solve simple financial and actuarial problems

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Assessment Task

2. Hand-in assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Problem solving based on comprehensive understanding

Excellent

(A+, A, A-) Consistently demonstrates a thorough understanding of statistical models and numerical methods for formulating and solving sophisticated financial and actuarial problems

Good

(B+, B) Adequately demonstrates an understanding of statistical models and numerical methods for formulating and solving financial and actuarial problems

Marginal

(B-, C+, C) Demonstrates limited understanding of statistical models and numerical methods and can seldom formulate and solve simple financial and actuarial problems

Failure

(F) Demonstrates little understanding of statistical models and numerical methods and can rarely or never formulate and solve simple financial and actuarial problems

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Assessment Task

3. Essays (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Creativity based on learning, software usage, and data analysis ability

Excellent

(A+, A, A-) Consistently exhibits a thorough understanding of the financial phenomena and other practical problems in the essays

Good

(B+, B) Sufficiently demonstrates comprehension of the financial phenomena and other practical problems in the essays

Marginal

(B-, C+, C) Displays a moderate and intermediate grasp of the the financial phenomena and other practical problems, clearly articulated in the essay

Failure

(F) Demonstrates some understanding of the financial phenomena and other practical problems in the essays

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Part III Other Information

Keyword Syllabus

Introduction to partial differential equations. Finite difference method. Monte Carlo simulation. Basic computational issues in finance

Reading List

Compulsory Readings

	Title
1	Course materials provided

Additional Readings

	Title
1	Derivatives Markets, by Robert L. McDonald, Pearson; 3rd edition