PHY5507: PHYSICAL METHODS IN FINANCIAL DATA MODELLING

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Physical Methods in Financial Data Modelling

Subject Code
PHY - Physics
Course Number
5507

Academic Unit
Physics (PHY)

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
Basic knowledge of statistics, big number theory, normal distribution, and curiosity to finance.

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Additional Information
Nil

Part II Course Details

Abstract

This is a class on the application of knowledge learned from studying physics to the world of finance. Armed with basic understanding of statistics (will be reenforced in the class) and related problem solving methods leared in physics class, we will explore the world of finance. Using derivatives as a tool, financial engineers invent products to help companies and investors manage risk and enhance returns, which also introduces new risks if applied improperly.

As most internship applications start in the fall for campus recruitment, this course provides a primer for students in the Department of Physics who are interested in applying for finance related jobs.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Have basic understanding of mathematical models in finance from physicist's perspective.	20	x	x	
2	Learn the basics of financial instruments and their uses.	40	x	x	
3	Understand the risk of financial instruments.	20	x	x	
4	Learn to use the financial instruments to mitigate different types of risks.	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	Lectures	Classroom teaching.	1, 2, 3, 4	2
2	Tutorials	Discussion of real world examples related to the lectures.	1, 2, 3, 4	1
3	Projects and assignments	One project to help students understand the course materials.	1, 2, 3, 4	1

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignments	1, 2, 3, 4	20	-	Yes
2	Projects	1, 2, 3, 4	20	-	No
3	Class attendance	1, 2, 3, 4	10	-	No

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Minimum Examination Passing Requirement (%)

30

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

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

Criterion

The student demonstrates a clear understanding of financial modeling concepts and applies physics-based problem-solving techniques to solve assigned problems independently.

Excellent

(A+, A, A-)High (demonstrates exceptional understanding of financial models with creative and accurate solutions)

Good

(B+, B, B-)Significant (shows good understanding with mostly accurate solutions)

Fair

(C+, C, C-)Moderate (demonstrates partial understanding with some accurate solutions)

Marginal

(D)Basic (demonstrates essential understanding with minimal accuracy)

Failure

(F)Not reaching marginal levels

Assessment Task

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

Criterion

The student collaborates effectively in a small group to research financial instruments and develop solutions for risk management or return enhancement, supported by physics-based methodologies.

Excellent

(A+, A, A-)High (demonstrates innovative solutions with strong collaboration and accurate application of concepts)

Good

(B+, B, B-)Significant (shows effective collaboration with mostly accurate solutions)

Fair

(C+, C, C-)Moderate (demonstrates some collaboration and partially accurate solutions)

Marginal

(D)Basic (demonstrates minimal collaboration and basic solutions)

Failure

(F)Not reaching marginal levels

Assessment Task

Class Attendance (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

The student consistently attends classes on time, actively engaging in discussions and activities.

Excellent

(A+, A, A-)High (attends $\geq$80% of classes with active participation)

Good

(B+, B, B-)Significant (attends $\geq$70% of classes with consistent participation)

Fair

(C+, C, C-)Moderate (attends $\geq$50% of classes with some participation)

Marginal

(D)Basic (attends $\geq$40% of classes with minimal participation)

Failure

(F)Not reaching marginal levels (<40% attendance)

Assessment Task

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

Criterion

The student applies knowledge from the course to solve finance-related problems accurately, demonstrating proficiency in financial modeling and risk management techniques.

Excellent

(A+, A, A-)High (solves problems with creativity and high accuracy)

Good

(B+, B, B-)Significant (solves problems with mostly accurate solutions)

Fair

(C+, C, C-)Moderate (solves problems with some accuracy)

Marginal

(D)Basic (solves problems with minimal accuracy)

Failure

(F)Not reaching marginal levels

Assessment Task

Assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

The student demonstrates a clear understanding of financial modeling concepts and applies physics-based problem-solving techniques to solve assigned problems independently.

Excellent

(A+, A, A-)High (demonstrates exceptional understanding of financial models with creative and accurate solutions)

Good

(B+, B)Significant (shows good understanding with mostly accurate solutions)

Marginal

(B-, C+, C) Basic (demonstrates essential understanding with minimal accuracy)

Failure

(F)Not reaching marginal levels

Assessment Task

Projects (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

The student collaborates effectively in a small group to research financial instruments and develop solutions for risk management or return enhancement, supported by physics-based methodologies.

Excellent

(A+, A, A-) High (demonstrates innovative solutions with strong collaboration and accurate application of concepts)

Good

(B+, B) Significant (shows effective collaboration with mostly accurate solutions)

Marginal

(B-, C+, C) Basic (demonstrates minimal collaboration and basic solutions)

Failure

(F) Not reaching marginal levels

Assessment Task

Class Attendance (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

The student consistently attends classes on time, actively engaging in discussions and activities.

Excellent

(A+, A, A-) High (attends ≥80% of classes with active participation)

Good

(B+, B) Significant (attends ≥70% of classes with consistent participation)

Marginal

(B-, C+, C) Basic (attends ≥40% of classes with minimal participation)

Failure

(F) Not reaching marginal levels (<40% attendance)

Assessment Task

Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

The student applies knowledge from the course to solve finance-related problems accurately, demonstrating proficiency in financial modeling and risk management techniques.

Excellent

(A+, A, A-) High (solves problems with creativity and high accuracy)

Good

(B+, B) Significant (solves problems with mostly accurate solutions)

Marginal

(B-, C+, C) Basic (solves problems with minimal accuracy)

Failure

(F) Not reaching marginal levels

Part III Other Information

Keyword Syllabus

- Overview of Physics and Finance: Basic Assumptions, model and application. How to approach real life problem usingwhat we learned in physics classes?
- Forecasting future in an uncertain world: Random Walk, and Brownian motion, and binomial model.
- Option theory and financial derivatives pricing.
- Financial instruments: Foreign exchange and interest rate products.
- Financial instruments: Equity and equity options.
- Financial instruments: commodity and commodity derivatives.
- Legal aspect of financial instruments: Hong Kong SFC licensing rules and margin financing.
- Counterparty credit risk of derivative products.
- Mitigating credit risks and managing new risks, ISDA and CSA.
- Enterprise Risk Management and economic capital.
- Helping companies to manage risk: Commodity and fx hedging.
- Conclusion: What can physicist contribute to Finance, and how to be a good finance engineer?

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Douglas W. Hubbard, “How to Measure Anything: Finding the Values of Intangibles in Business”, Wiley; 3rd edition,2014
2	Frank J. Fabozzi, “The Handbook of Fixed Income Securities”, McGraw-Hill Education, 8th Edition, 2012.
3	John Hull, “Options, Futures, and Other Derivatives”, Pearson, 10th Edition, 2017.
4	John Hull, “Risk Management and Financial Institutions”, Wiley; 5th Edition, 2018