PHY3220: FINANCIAL ENGINEERING FROM A SCIENTIST’S PERSPECTIVE

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Financial Engineering from a Scientist’s Perspective

Subject Code
PHY - Physics
Course Number
3220

Academic Unit
Physics (PHY)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
PHY1101 Introductory Classical Mechanics or
AP1201/PHY1201 General Physics I*

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Additional Information
* This pre-requisite requirement is waived for Advanced Standing I students and Advanced Standing II students.

Part II Course Details

Abstract

This is an introductory class on the application of knowledge learned from studying physics to the world of finance. Armed with basic understanding of statistics (will be reinforced in the class) and related problem solving methods learned in physics, we will explore the world of financial engineering. Using derivative as a tool, financial engineers invent products to help companies and investors manage risk and enhance returns, which also introduce new risks if applied improperly. As most internship applications start in the fall of year 3 for undergraduate students, this course provides a primer for students at physics department 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 a physicist’s perspective.	20	x	x	
2	Learn the basics of financial instruments and their use.	40	x	x	
3	Understand the risks of financial instruments from a physicist’s perspective.	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.

Teaching and Learning Activities (TLAs)

	TLAs	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	2 projects to help students understand the course materials.	1, 2, 3, 4	1

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2, 3, 4	20	
2	Projects	1, 2, 3, 4	20	
3	Class attendance	1, 2, 3, 4	10	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

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. Assignments

Criterion

Demonstrate understanding of basic concepts and solve assigned problems independently

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reachingmarginal levels

Assessment Task

2. Projects

Criterion

Ability to work in a small group to research the issue and work out a solution together.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reachingmarginal levels

Assessment Task
3. Class Attendance

Criterion
Attending class on time

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reachingmarginal levels

Assessment Task
4. Examination

Criterion
Ability to solve finance related problems using the knowledge learned from the class.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reachingmarginal levels

Part III Other Information

Keyword Syllabus

- Overview of Physics and Finance: Basic Assumptions, model and application. How to approach real life problem using what 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