

UNIVERSITY OF PENNSYLVANIA
The Wharton School

FNCE 7170:
FINANCIAL DERIVATIVES

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Course Description

The course provides an introduction to financial derivatives and to the markets in which they are traded, as well as to the models and analytical tools that are used to value them and to assess and manage their risk.

Derivatives have experienced a phenomenal pace of growth and innovation in recent years. Accordingly, it is critical to have an understanding of the strategic opportunities offered by these securities and of the risks they can pose if used improperly. In addition, many of the techniques developed to analyze and manage derivatives can also be (and are) applied to a wide range of financial decisions and investments—such as real investment opportunities, corporate securities, executive compensation packages and mergers and acquisitions—to the point that it is impossible to understand much of modern finance without understanding derivatives.

The main focus of the class will be on equity derivatives, although, as mentioned, the concepts are broadly applicable.

Analytical tools play a critical role in the valuation and management of derivatives. Although every effort will be made to introduce these tools as intuitively as possible and the technical requirements are limited to basic calculus and statistics, the class is by its nature quantitative and will require a steady amount of work. In addition, some computer proficiency will be required for the assignments, although familiarity with a spreadsheet program (such as *Microsoft Excel*) will suffice.

Prerequisites

The prerequisite for this class is the core finance class, i.e., FNCE 6110. An introductory statistics class (i.e., STAT 6130 or equivalent) is strongly recommended but not required.

Textbook and Reading Material

The course will be based primarily on lecture notes (copies of the slides used in class) and on the following required textbook:

John Hull, *Options, Futures, and Other Derivatives*, 11th ed. (New York: Pearson, 2022).

Errata, answers to the end-of-chapter questions and other supporting material for the textbook can be found on the [author's website](#).

The lecture notes will be posted on Canvas ahead of each class. Additional reading material will also be posted on Canvas as needed.

Class Schedule and Attendance

The class will run on the [MBA Academic Calendar](#).

You are expected to attend every class and to use the [aPlus+ Attendance app](#) in Canvas to check into classes and to request that an absence be excused when warranted. In addition, you may use the [Class Recording Permissions app](#) to request access to the video recording of a class, but only if you have a valid reason and in any case no later than two weeks from the class date.

Office Hours and Canvas Discussions

I am available by appointment. Please email me and we will set up a time to meet in person or by videoconference.

The schedule of the TA's office hours will be posted on Canvas.

In addition, you may and are strongly encouraged to use the Discussions module in Canvas for questions relating to the course material and assignments or that might otherwise have general interest to the class. I will reply quickly to questions posted there.

Assignments and Grading

The final grade for the course will be based on class participation and three home assignments, with the following weights:

Assignment 1	20%
Assignment 2	30%
Assignment 3	30%
Class participation	20%

There will be no midterm or final exam.

Class participation will score both your attendance and your contribution to an active and productive class environment.

The assignments will be posted on Canvas at least two weeks before their due date. You must complete the assignments either individually or in teams of no more than two people. However, you must write down your own answers and submit them individually, specifying your teammate (if any) in your submission.

You cannot discuss the assignments with anybody other than your teammate (the University's [MBA Code of Ethics](#) applies), but you are welcome to use the office hours or Canvas Discussions to address questions regarding the conceptual tools underlying the assignments or to request clarifications if needed.

An answer sheet for each assignment will be posted on Canvas after the assignment's due date. We will not go over the answer sheets in class, but you should review them and use the office hours or Canvas Discussions to clarify anything that is unclear. Grades for each assignment and summary statistics of the grade distribution will also be posted on Canvas.

Course Outline

Below is an outline of the course, illustrating the planned progression of topics and the corresponding readings. Each section below will be the topic of one of the lecture notes to be posted on Canvas.

1. Introduction to Financial Derivatives

Lecture notes and Textbook, Chapter 1 and Sections 4.1–4.4.

FORWARDS, FUTURES AND SWAPS

2. Introduction to Forwards and Futures

Lecture notes and Textbook, Chapter 2.

3. Pricing Equity Forwards and Futures

Lecture notes and Textbook, Sections 5.1–5.9.

4. Static Hedging with Equity Forwards and Futures

Lecture notes and Textbook, Chapter 3.

5. Equity Swaps

Lecture notes and Textbook, Section 34.4.

OPTIONS

6. Introduction to Vanilla Options

Lecture notes and Textbook, Chapter 10.

7. Basic Properties of Vanilla Equity Options

Lecture notes and Textbook, Chapter 11.1–11.4.

8. Static Option Strategies

Lecture notes and Textbook, Chapter 12.

9. The Binomial Model: Introduction

Lecture notes and Textbook, Sections 13.1–13.4 and 13.6.

10. The Binomial Model: Calibration

Lecture notes and Textbook, Sections 13.7–13.10, 15.4 and 21.4.

11. The Binomial Model: Accounting for Dividends

Lecture notes and Textbook, Sections 13.11 (“Options on Stocks paying a Continuous Dividend Yield” and “Options on Stock Indices”) and 21.3 (“Known Dividend Yield” and “Known Dollar Dividend”).¹

¹Skip Example 21.5, which deals with an American put.

12. American Equity Options: The Early Exercise Decision

Lecture notes and Textbook, Sections 11.5–11.7 and 15.12 (“American Call Options”).

13. American Equity Options: Pricing and Replication

Lecture notes and Textbook, Sections 13.5 and 17.6.

14. Futures Options

Lecture notes and Textbook, Sections 18.1,² 18.2–18.5 and 18.9–18.10.

15. The Black-Scholes-Merton Model

Lecture notes and Textbook, Sections 14.1–14.4, 15.1–15.2, 15.5, 15.7–15.9, 17.3–17.4 and 26.10.

16. The Black Model

Lecture notes and Textbook, Sections 18.6–18.8.

17. The Volatility Surface and the Practitioners’ BSM model

Lecture notes and Textbook, Sections 15.11,³ 20.1, 20.3–20.5 and 20.7–20.8.

18. Monte Carlo Simulation and Stochastic Volatility

Lecture notes and Textbook, Sections 21.6⁴ and 21.7 (“Antithetic Variable Technique”).

19. The Option Greeks

Lecture notes and Textbook, Sections 19.3, 19.4,⁵ 19.5, 19.6,⁶ 19.7–19.9, 19.12, 21.1 (“Estimating Deltas and Other Greek Letters”) and 21.6 (“Calculating the Greek Letters”).

ADDITIONAL TOPICS AND APPLICATIONS

20. Dynamic Hedging in Practice

Lecture notes and Textbook, Sections 19.1–19.2, 19.4 (“Dynamic Aspects of Delta Hedging”, “Where the Cost Comes From” and “Transaction Costs”), 19.6 (“Making a Portfolio Gamma Neutral”) and 19.10–19.11.

21. Volatility Indices and Volatility Derivatives

Lecture notes and Textbook, Sections 15.11 (“The VIX Index”) and 26.16.

²Skip “Options on Interest Rate Futures”.

³Skip “The VIX Index”

⁴Skip “Calculating the Greek Letters”.

⁵Skip “Dynamic Aspects of Delta Hedging”, “Where the Cost Comes From” and “Transaction Costs”.

⁶Skip “Making a Portfolio Gamma Neutral”.