University of St.Gallen

# Course and Examination Fact Sheet: Spring Semester 2025

# 8,152: Derivatives

# ECTS credits: 4

## Overview examination/s

(binding regulations see below)
decentral - Written examination, Analog, Individual work individual grade (100%, 90 mins.)
Examination time: Term time

## Attached courses

Timetable -- Language -- Lecturer
8,152,1.00 Derivatives -- English -- Orlov Vitaly , Fengler Matthias Reginald

## Course information

### Course prerequisites

As prerequisites the courses "Financial Markets" and "Quantitative Methods" are required. No previous derivatives courses are required.

### Learning objectives

- Students acquire a thorough understanding of how derivative instruments and models work.
- Exercises deliver practical learning and applications of taught material and deepen knowledge of the topics presented.

### Course content

The primary objective of this course is to provide students with an advanced introduction to derivative instruments, concepts, applications, and models necessary to analyze those instruments. The course is designed for students interested in modern financial instruments, their applications, and quantitative methods.

### Course structure and indications of the learning and teaching design

**Session 1: Introduction, Futures, Hedging**

- Hedging
- Hedge ratio
- Basis risk
- Cross hedging

**Session 2: State Preference Theory**

- Arbitrage
- Arrow-Debreu securities
- Complete and incomplete markets
- Risk-neutral valuation

**Session 3: Binomial Model**

- Binomial trees
- Replication

- Risk-neutral valuation
- American and European options

**Session 4: Black-Scholes**

- Stochastic calculus
- Replication
- Fundamental partial differential equation
- Risk-neutral valuation
- Black-Scholes formula
- Options on indices, currencies, futures
- Implied volatility
- Volatility smile
- Greeks
- Dynamic hedging

**Session 5: Exotic Options and Numerical Methods**

- Monte Carlo simulation
- Pricing and hedging exotic options

**Session 6: Financial Engineering, Structured Products**

- Engineering payoff structures
- Structured products
- Pricing

**Session 7: Advanced Pricing Models**

- Local volatility model
- Stochastic volatility
- Jump diffusions
- Estimation and calibration
- Model risk

**Session 8: Implied Densities**

- Implied densities
- Parametric and nonparametric estimation techniques
- Use cases of implied densities
- Implied risk aversion
- The pricing kernel puzzle

**Session 9: Volatility Derivatives**

- Volatility and variance swaps
- VIX index
- VIX options and futures

**Session 10: Interest Rate and FOREX Derivatives**

- Bond options
- Caps and floors
- Swaptions
- Forex derivatives

**Session 11: Credit Derivatives**

- Credit risk
- Credit default swaps
- Collateralized debt obligations

## Course literature

John C. Hull, *Options, Futures, and Other Derivatives, 11th Ed., Pearson, 2021* (recommended chapters)

Lecture Notes, *Introduction to Option Pricing*.

*Schoutens, Simons, Tistaert: A perfect calibration! Now What? Wilmo 2004(2)*

*Reiswich and Wystup: A Guide to FX Options Quoting Conventions, The Journal of Derivatives, Winter 2010, 18(2), pp.58-68*

The course material (slides & lecture notes) will be made available on StudyNet.

## Additional course information

The independent studies include the lecture notes as mandatory reading. Four problem sets will be made available on StudyNet and discussed in the respective sessions.

# Examination information

## Examination sub part/s

## 1. Examination sub part (1/1)

### Examination modalities

| | |
|---|---|
| Examination type | Written examination |
| Responsible for organisation | decentral |
| Examination form | Written exam |
| Examination mode | Analog |
| Time of examination | Term time |
| Examination execution | Synchronous |
| Examination location | On Campus |
| Grading type | Individual work individual grade |
| Weighting | 100% |
| Duration | 90 mins. |

### Examination languages

Question language: English
Answer language: English

### Remark

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### Examination-aid rule

Closed Book

The use of aids is prohibited as a matter of principle, with the exception of pocket calculator models of the Texas Instruments TI-30 series and, in case of non-language exams, bilingual dictionaries without any handwritten notes. Any other aids that are admissible must be explicitly listed by faculty members in the paragraph entitled “Supplementary aids” of the course and examination fact sheet; this list is exhaustive.

Procuring any aids, as well as ensuring their working order, is the exclusive responsibility of students.

### Supplementary aids

You may bring a double-sided A4 cheat sheet.

## Examination content

The exam covers all topics discussed in the course.

## Examination relevant literature

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## Please note

Please note that only this fact sheet and the examination schedule published at the time of bidding are binding and takes precedence over other information, such as information on StudyNet (Canvas), on lecturers' websites and information in lectures etc.
Any references and links to third-party content within the fact sheet are only of a supplementary, informative nature and lie outside the area of responsibility of the University of St.Gallen.

Documents and materials are only relevant for central examinations if they are available by the end of the lecture period (CW21) at the latest. In the case of centrally organised mid-term examinations, the documents and materials up to CW 13 (Monday, 25 March 2025) are relevant for testing.

Binding nature of the fact sheets:

- Course information as well as examination date (organised centrally/decentrally) and form of examination: from bidding start in CW 04 (Thursday, 23 January 2025);
- Examination information (supplementary aids, examination contents, examination literature) for decentralised examinations: in CW 12 (Monday, 17 March 2025);
- Examination information (supplementary aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 14 (Monday, 31 March 2025);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: two weeks before ending with de-registration period in CW 15 (Monday, 07 April 2025).