

## Course guide

# 230320 - EFPEI - Financial Engineering for Economic Planning of Investments

Last modified: 25/05/2023

**Unit in charge:** Barcelona School of Telecommunications Engineering  
**Teaching unit:** 744 - ENTEL - Department of Network Engineering.

**Degree:** BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).  
BACHELOR'S DEGREE IN ELECTRONIC ENGINEERING AND TELECOMMUNICATION (Syllabus 2018). (Optional subject).

**Academic year:** 2023    **ECTS Credits:** 2.0    **Languages:** Spanish

## LECTURER

**Coordinating lecturer:** Consultar aquí / See here:  
<https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura>

**Others:** Consultar aquí / See here:  
<https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma>

## PRIOR SKILLS

Basic calculus (integrals, derivatives, partial derivatives, Taylor expansion, etc.), Linear Algebra (Matrices and operations) and probability theory (mean, variance, normal random variables, Poisson, etc.)

## TEACHING METHODOLOGY

## LEARNING OBJECTIVES OF THE SUBJECT

Economic planning of an investment is not simple or easy sometimes. The economic constraints of enterprises to tackle this task requires the use of financial tools to evaluate, through appropriate methods the characteristics and timing of investment to make. This seminar introduces the essential foundations of financial engineering in the economic planning of network investments and provides the basic mathematical tools to address these challenges. Attendance at this seminar can be very attractive, since not only the basics of financial engineering but also the way they treat are introduced, reviewing math skills already acquired.

## STUDY LOAD

Type	Hours	Percentage
Self study	30,0	60.00
Hours large group	20,0	40.00

**Total learning time:** 50 h

## CONTENTS

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### 1- Introduction to the seminar

**Description:**

- 1.1. Main objectives of the seminar
- 1.2. Basics of financial engineering (interest rate, bonds, futures contracts, options on assets, etc.)
- 1.3. Application exercises

**Full-or-part-time:** 2h

Theory classes: 2h

### 2- Mathematics in financial engineering. Review

**Description:**

- 2.1. Reviewing calculus (integration, derivation, Taylor developments, etc)
- 2.2. Probability review
- 2.3. Linear algebra review
- 2.4. Application exercises

**Full-or-part-time:** 4h

Theory classes: 4h

### 3- Interest rate and bonds

**Description:**

- 3.1. Compound Interest
- 3.2. Bond yields
- 3.3. Application exercises

**Full-or-part-time:** 2h

Theory classes: 2h

### 4- Forward and futures prices

**Description:**

- 4.1. Trading strategies
- 4.2. Determination of forward and futures prices
- 4.3. Application exercises

**Full-or-part-time:** 2h

Theory classes: 2h

## 5- Pricing financial derivatives. Pricing an option

### Description:

- 5.1. Trading strategies involving options
- 5.2. European and American options
- 5.3. Methods to price options. Methods:
  - 5.3.1. Binomial trees
  - 5.3.2. Cox Rubinstein formula
  - 5.3.3. Black-Scholes-Merton. Implied volatility
  - 5.3.4. Monte Carlo simulation
- 5.4. Application exercises

**Full-or-part-time:** 8h

Theory classes: 8h

## 6- Efficient Portfolios. Risk management. Markowitz's portfolios

### Description:

- 6.1. Maximum expected value of the return on a portfolio
- 6.2. Efficient Portfolios. Maximum expected return and minimum variance
- 6.3. Application exercises

**Full-or-part-time:** 2h

Theory classes: 2h

## GRADING SYSTEM

## BIBLIOGRAPHY

### Basic:

- Wilmott, Paul. Paul Wilmott introduces quantitative finance [on line]. 2nd ed. Wiley, 2007 [Consultation: 02/04/2020]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?docID=309819>. ISBN 9780470319581.
- Stefanica, Dan. A primer for the Mathematics of Financial Engineering. 2nd ed. New York: FE Press, 2011. ISBN 9780979757624.
- Capinski, Marek, Zastawniak, Tomasz. Mathematics for finance : an introduction to financial engineering [on line]. 2nd ed. London ; New York: Springer, 2003 [Consultation: 13/05/2020]. Available on: <http://link.springer.com/book/10.1007/b97511>.
- Neftci, Salih N.; Hirsu, Ali. An Introduction to the mathematics of financial derivatives. 3rd ed. San Diego [etc.]: Academic Press, 2014. ISBN 9780123846822.
- Hull, John. Options, futures and other derivatives. 9th ed. Harlow [etc.]: Pearson, 2015. ISBN 9780133456318.