

Course guide

230357 - FEN - Financial Engineering: Applications to Information Technology Projects

Last modified: 09/11/2022

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

Degree: Academic year: 2022 ECTS Credits: 2.5
Languages: English

LECTURER

Coordinating lecturer:

Others:

PRIOR SKILLS

Basic mathematical background about calculus and matrix operations

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CE7. Ability to plan networks and decision-making about services and applications taking into account: quality of service, operational and direct costs, implementation plan, supervision, security processes, scalability and maintenance. Ability to manage and assure the quality during the development process

CE8. Ability to understand and to know how to apply the functioning and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services

CE9. Ability to deal with the convergence, interoperability and design of heterogeneous networks with local, access and core networks, as well as with service integration (telephony, data, television and interactive services).

CE15. Ability to integrate Telecommunication Engineering technologies and systems, as a generalist, and in broader and multidisciplinary contexts, such as bioengineering, photovoltaic conversion, nanotechnology and telemedicine.

CE16. Ability to develop, direct, coordinate, and technical and financial management of projects in the field of: telecommunication systems, networks, infrastructures and services, including the supervision and coordination of other's subprojects; common telecommunications infrastructures in buildings or residential areas, including digital home projects; telecommunication infrastructures in transport and environment; with corresponding energy supply facilities and assessment of electromagnetic emissions and electromagnetic compatibility.

Transversal:

CT1a. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.

CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

- Lectures
- Application classes
- Exercises
- Oral presentations
- Extended answer test (Final Exam)

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives and results of the subject:

The use of quantitative models in trading has grown tremendously in recent years, and seems likely to grow at similar speed in the future, due to the availability of ever faster and cheaper computing power. In this seminar the mathematical foundations of the topics required to understand these models, in a clear way, will be presented, as well as, a number of their main direct fundamentals and applications related to the Information Technology. The audience of this seminar will find it very rewarding as it will give them a head start in financial engineering and also provide them a reference of the mathematical topics involved in its treatment

Learning results of the subject:

- Ability to specify, design networks, services, processes and applications of telecommunications in both a fixed, mobile, personal, local or long distance, with different bandwidths in multicast networks, including voice and data.
- Ability to apply both traffic engineering tools as planning tools, dimensioning and network analysis.
- Ability to analyse, model and implement new architectures, network protocols and communication interfaces and new network services and applications.
- Ability to analyse, model and apply advanced techniques both security, including cryptographic protocols, firewalls, and collection mechanisms, authentication and content protection.

STUDY LOAD

Type	Hours	Percentage
Self study	42,5	68.00
Hours large group	20,0	32.00

Total learning time: 62.5 h

CONTENTS

1. Introduction. Scope of the seminar

Description:

- Fundamentals in Finance
- Basic concepts in financial: compound interest bonds, forward and future contracts, options, etc.

Full-or-part-time: 6h

Theory classes: 2h

Self study : 4h

2. Mathematical background revisited

Description:

- Calculus review: Differentiation and integration. Taylor expansions
- Linear Algebra: Matrix operations
- Exercises

Full-or-part-time: 6h 30m

Theory classes: 2h

Self study : 4h 30m

3. Forward and futures contracts

Description:

- Definitions and operation strategies. Differences between forward and futures contracts
- Evaluation of the price of futures contracts
- Application examples to IT examples

Full-or-part-time: 9h

Theory classes: 3h

Self study : 6h

4. Financial options

Description:

- Bonds and interest rate
- European and American options
- Pricing options
- Binomial trees
- Stochastic processes (Black-Scholes-Merton model)
- Other methods
- Application examples to IT examples

Full-or-part-time: 22h

Theory classes: 7h

Self study : 15h

5. Real Options

Description:

- Fundamentals on real options. Differences with financial options
- Valuation of projects in scenarios without uncertainty. Net Present Value model
- Valuation of projects in scenarios with uncertainty. Types of real options
 - Binomial trees
 - Other methods
- Application examples to IT projects

Full-or-part-time: 19h

Theory classes: 6h

Self study : 13h

GRADING SYSTEM

Final examination: from 40% to 60%

Exercises: from 25% to 40%

Individual assessments: from 10% to 20%

Exercises:

- Description: Exercises to strengthen the theoretical knowledge

Oral presentation:

- Description: Presentation of a work

Extended answer test (Final examination):

- Description: Final examination.

BIBLIOGRAPHY

Basic:

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- Hirsu, A.; Neftci, S. N. An Introduction to the Mathematics of Financial derivatives. 3rd ed. San Diego: Academic Press, 2013. ISBN 9780123846822.
- Capinski, M.; Zastawniak, T. Mathematics for finance : an introduction to financial engineering [on line]. 2nd ed. London: Springer, 2003 [Consultation: 04/09/2020]. Available on: <https://link.springer.com/book/10.1007/b97511>. ISBN 9780857290816.
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- Trigeorgis, L. Real options : managerial flexibility and strategy in resource allocation. Cambridge (Mass.), etc: MIT Press, 1996. ISBN 026220102X.
- Copeland, T. Real options : a practitioner's guide. Texere Publishing, 2003. ISBN 9781587991868.
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- Rokkas, T.; Katsianis, D.; Varoutas, D. "Techno-economic Evaluation of FTTC/VDSL and FTTH Roll-Out Scenarios: Discounted Cash Flows and Real Option Valuation". Journal of Optical Communications and Networking [on line]. 2010, vol. 2, nº 9, p. 760-772 [Consultation: 13/05/2021]. Available on: <https://www.osapublishing.org/jocn/viewmedia.cfm?uri=jocn-2-9-760&seq=0>.