



## Course guides

### 230619 - NET - Network Science

Last modified: 29/04/2020

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

**Degree:** MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Optional subject).  
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).

**Academic year:** 2020    **ECTS Credits:** 5.0    **Languages:** English

#### LECTURER

---

**Coordinating lecturer:** JOSÉ LUIS MELÚS MORENO

**Others:** MARCOS POSTIGO BOIX

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

---

##### Specific:

1. 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).
2. Ability to design and dimension transport, broadcast and distribution networks for multimedia signals
3. 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.
4. Ability to model, design, implement, manage, operate, administrate and maintain networks, services and contents
5. 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
6. 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

##### Transversal:

7. 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.
8. 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
- Individual work (distance)
- Exercises
- Exams



## LEARNING OBJECTIVES OF THE SUBJECT

---

Learning objectives of the subject:

The aim of this course is to understand the role of social networks in our lives. Social networks pervade our social and economic lives. They play a central role in the transmission of information about job opportunities and are critical to the trade of many goods and services. The countless ways in which network structures affect our lives make it critical to understand how social networks structures impact behavior, which network structures are likely to emerge in a society, and why we organize ourselves as we do.

## STUDY LOAD

---

Type	Hours	Percentage
Hours large group	39,0	31.20
Self study	86,0	68.80

**Total learning time:** 125 h

## CONTENTS

---

### 1. Introduction and overview

**Description:**

- Aspects of networks
- Examples of networks
- Why model networks?
- Networks of information. Internet.

**Full-or-part-time:** 3h 13m

Theory classes: 1h

Self study : 2h 13m

### 2. Fundamentals of network theory

**Description:**

- Mathematics of networks. Graph theory
- Measures and metrics
- The large scale structure of networks

**Full-or-part-time:** 19h 14m

Theory classes: 6h

Self study : 13h 14m

### 3. Network models

**Description:**

- Random networks
- Models of network formation
- Small-world phenomenon
- Strategic network formation
- Power laws and rich get richer

**Full-or-part-time:** 19h 14m

Theory classes: 6h

Self study : 13h 14m

### 4. Network dynamics

**Description:**

- Information cascades behavior
- Network effects
- Diffusion of innovation

**Full-or-part-time:** 19h 14m

Theory classes: 6h

Self study : 13h 14m

### 5. Behavior and networks

**Description:**

- Games. Nash equilibrium. Mixed strategies. Pareto Optimality
- Extensive Games
- Evolutionary game theory

**Full-or-part-time:** 32h 02m

Theory classes: 10h

Self study : 22h 02m

### 6. Networks and Markets

**Description:**

- Matching markets
- Bargaining and Power in networks
- Information networks and the WWW. Web search (PageRank algorithm)
- Auctions. Adds in Google.

**Full-or-part-time:** 25h 38m

Theory classes: 8h

Self study : 17h 38m



## ACTIVITIES

---

### EXERCISES

**Description:**

Exercises to strengthen the theoretical knowledge.

### EXTENDED ANSWER TEST (FINAL EXAMINATION)

**Description:**

Final examination.

## GRADING SYSTEM

---

First part (Lessons 1, 2, 3 and 4): Exam 30%, Continuous Assessments 20%

Second part (Lessons 5 and 6): Exam 30%, Continuous Assessments 20%

## BIBLIOGRAPHY

---

**Basic:**

- Easley, D.; Kleinberg, J. Networks, crowds, and markets: reasoning about a highly connected world. New York: Cambridge University Press, 2010. ISBN 978-0-521-19533-1.
- Jackson, M.O. Social and economic networks. Princeton University Press, 2011. ISBN 978-0-691-14820-5.
- Newman, M.E.J. Networks. 2nd ed. Oxford: Oxford University Press, 2018. ISBN 9780198805090.