Course guides
230619 - NET - Network Science

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>39.0</td>
<td>31.20</td>
</tr>
<tr>
<td>Self study</td>
<td>86.0</td>
<td>68.80</td>
</tr>
</tbody>
</table>

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:**
- 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: