Course guide
230618 - WAN - Wireless Access Networks

Last modified: 25/05/2023

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: 2023   **ECTS Credits:** 5.0   **Languages:** English

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

- Local Area Networks
- TCP/IP Protocol Architecture

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Ability to develop radio-communication systems: antennas design, equipment and subsystems, channel modeling, link dimensioning and planning.
2. Ability to implement wired/wireless systems, in both fix and mobile communication environments.

Transversal:
3. 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.

4. 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
- Group work
- Exercises
- Short answer test

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives:
The aim of this course is to introduce new subjects and technologies related to wireless communication systems, focusig on those used as access networks. The main objective is to introduce concepts and technologies and to offer the analytical tools to understand its performance and to been able to dimension its capacity
Learning results:
- Ability to design radio systems for providing voice and data services, at any time and place.
- Ability to understand the behaviour and dimension certain wireless systems used commonly.

STUDY LOAD

Type	Hours	Percentage
Hours large group	26,0	20.80
Hours small group	13,0	10.40
Self study	86,0	68.80

Total learning time: 125 h

CONTENTS

1. Introduction to Wireless Access Networks

Description:
- Parts of a network.
- Wireless Access Networks.
- Radioelectric spectrum.
- Spectrum division techniques: TDMA, FDMA, CDMA, OFDMA.
- Duplexing techniques: TDD and FDD.

Full-or-part-time: 11h
Theory classes: 2h
Laboratory classes: 1h
Self study : 8h

2. Resources Allocation Strategies.

Description:
- Frequency reuse.
- Code reuse.
- Optimized systems.
- Examples of use.

Full-or-part-time: 11h
Theory classes: 2h
Laboratory classes: 1h
Self study : 8h

3. LPWAN Networks.

Description:
- Sigfox.
- Lora.

Full-or-part-time: 11h
Theory classes: 2h
Laboratory classes: 1h
Self study : 8h

4. Point to Multipoint Systems.

Description:
- WiMAX.

Full-or-part-time: 11h
Theory classes: 2h
Laboratory classes: 1h
Self study : 8h

5. Trunking Systems.

Description:
- Analog technologies.
- Digital technologies. TETRA.
- Dimensioning.

Full-or-part-time: 22h
Theory classes: 4h
Laboratory classes: 2h
Self study : 16h

6. Delay Tolerant Networks (DTN).

Description:
- Architecture.
- Routing.
- Applications.

Full-or-part-time: 11h
Theory classes: 2h
Laboratory classes: 1h
Self study : 8h

8. Satellite Systems.

Description:
- GEO (Geostationary Orbit).
- MEO (Medium Earth Orbit).
- LEO (Low Earth Orbit).

Full-or-part-time: 11h
Theory classes: 2h
Laboratory classes: 1h
Self study : 8h

8. Multi-Hop Access Networks.

Description:
- Topologies and advantages.
- Ad-hoc networks and mesh networks.
- Routing protocols.
- Application examples.

Full-or-part-time: 37h
Theory classes: 10h
Laboratory classes: 5h
Self study : 22h

ACTIVITIES

LABORATORY

Description:
- LoRa Networks analysis.
- Implementation and analysis of ad-hoc and mesh networks with linux embedded devices.

Full-or-part-time: 7h
Laboratory classes: 7h

EXERCISES

Description:
- Design, dimensioning and evaluation exercises focused on the technologies studied studied during the course.

Full-or-part-time: 6h
Laboratory classes: 6h

SHORT ANSWER TEST (CONTROL)

Description:
1st Mid term control.
2nd Mid term control.
Final exam.

Full-or-part-time: 7h
Theory classes: 7h

GRADING SYSTEM

Final exam: 60%
Midterm controls: 25%
Individual assessments: 15%

BIBLIOGRAPHY

Basic:

- Stavroulakis, P. Terrestrial trunked radio : TETRA : a global security tool [on line]. Berlin [etc.]: Springer, 2007 [Consultation: 14/09/2016]. Available on: http://dx.doi.org/10.1007/3-540-71192-9. ISBN 9783540711902.
- Nuaymi, L. WiMAX : technology for broadband wireless access. Chichester: John Wiley & Sons, 2007. ISBN 9780470028087.
- Hammuda, H. Cellular mobile radio systems. John Wiley & Sons, 1998. ISBN 0471956414.
- Barbeau, M.; Kranakis, E. Principles of Ad-hoc Networking. John Wiley & Sons, 2007. ISBN 9780470032909.