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230618 - WAN - Wireless Access Networks

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 744 - ENTEL - Department of Network Engineering

Academic year: 2019

Degree: MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Teaching unit Optional)
MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009). (Teaching unit Optional)
MASTER'S DEGREE IN NETWORK ENGINEERING (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: Cruz Llopis, Luis Javier De La

Others: Paradells Aspas, Jose

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

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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

Total learning time: 125h	Hours large group:	26h	20.80%
	Hours medium group:	0h	0.00%
	Hours small group:	13h	10.40%
	Guided activities:	0h	0.00%
	Self study:	86h	68.80%

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Content

1. Introduction to Wireless Access Networks

Learning time: 11h
Theory classes: 2h
Laboratory classes: 1h
Self study : 8h

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

2. Resources Allocation Strategies.

Learning time: 11h
Theory classes: 2h
Laboratory classes: 1h
Self study : 8h

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

3. LPWAN Networks.

Learning time: 11h
Theory classes: 2h
Laboratory classes: 1h
Self study : 8h

Description:
- Sigfox.
- Lora.

4. Point to Multipoint Systems.

Learning time: 11h
Theory classes: 2h
Laboratory classes: 1h
Self study : 8h

Description:
- WiMAX.

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5. Trunking Systems.	Learning time: 22h Theory classes: 4h Laboratory classes: 2h Self study : 16h

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

6. Delay Tolerant Networks (DTN).	Learning time: 11h Theory classes: 2h Laboratory classes: 1h Self study : 8h

Description:
- Architecture.
- Routing.
- Applications.

8. Satellite Systems.	Learning time: 11h Theory classes: 2h Laboratory classes: 1h Self study : 8h

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

8. Multi-Hop Access Networks.	Learning time: 37h Theory classes: 10h Laboratory classes: 5h Self study : 22h

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

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Planning of activities

LABORATORY	Hours: 7h Laboratory classes: 7h

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

EXERCISES	Hours: 6h Laboratory classes: 6h

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

SHORT ANSWER TEST (CONTROL)	Hours: 7h Theory classes: 7h

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

Qualification system

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

Bibliography

Basic:

Hammuda, H. Cellular mobile radio systems. John Wiley & Sons, 1998. ISBN 0471956414.

Nuaymi, L. WiMAX : technology for broadband wireless access. Chichester: John Wiley & Sons, 2007. ISBN 9780470028087.

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.

Barbeau, M.; Kranakis, E. Principles of Ad-hoc Networking. John Wiley & Sons, 2007. ISBN 9780470032909.