300477 - MOBCOMM - Mobile Communications

Coordinating unit: 300 - EETAC - Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2019
Degree: MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Teaching unit Optional)
ECTS credits: 5 Teaching languages: English

Teaching staff
Coordinator: Ruiz Boque, Silvia
Others: Ruiz Boque, Silvia

Prior skills
Radiocommunications. Digital communications systems.

Teaching methodology
Lectures, problem solving and case discussion.
Lectures will give introductory material, while through problems and cases more advanced topics and tools will be analysed.

Each of the topics described at the Detailed Contents section will be done in one hour lecture. Out of class activities will be:
a) study additional material provided by the teacher
b) solve problems/cases related with the theory session
c) readings of technical/divulgaton papers related with the topic.

Learning objectives of the subject
At the end of the course the student should be able to:

understand the latest results, trends, activities and applications in the 4G, IoT, M2M and cooperative communications domain.
Perform a system level planning of any cellular network.
Design a 4G planning for a given geographical area
Design a IoT network choosing the appropriate technologies.
Design a M2M application
# Content

## Unit 1: LTE and LTE-A Networks

**Description:**
- OFDMA, SC-FDM, physical layer and network structure
- S1 and X2 interfaces
- Mobility and Radio Resource Management
- Link Budget, data rates, coverage and capacity
- LTE-A releases 8-9 and 10-12
- Carrier Aggregation, CoMP and MIMO solutions

**Related activities:**
Related activities: case discussion based on readings on applied aspects of LTE and LTE-A, use of hand-on tutorials and problem solving

**Learning time:** 18h  
Theory classes: 6h  
Self study: 12h

## Unit 2: HetNets and dense cell deployment

**Description:**
- Heterogeneous Networks (HetNet)
- Coordinated Multipoint (CoMP)
- Relay nodes (RN)
- Small Cell enhancements (SCE)
- 3D beamforming & Massive MIMO

**Related activities:**
Related activities: case discussion based on readings on applied aspects of WSN and IoT, use of hand-on tutorials and problem solving

**Learning time:** 15h  
Theory classes: 5h  
Self study: 10h

## Unit 3: WSN and IoT

**Description:**
- Introduction to WSN architectures
- Radio level WLAN interworking
- Machine Type Communication (MTC) and Device-to-Device Communication (D2D)
- LTE-M and NB-IoT and examples in real scenarios

**Related activities:**
Related activities: case discussion based on readings on applied aspects of WSN and IoT, use of hand-on tutorials and problem solving.

**Learning time:** 15h  
Theory classes: 5h  
Self study: 10h
### Unit 4: Cooperative Communications

**Learning time:** 12h  
Theory classes: 4h  
Self study: 8h

**Description:**
* Networking protocols  
* Cooperative strategies and rates  
* Network coding  
* Cooperative PHY and MAC

**Related activities:**  
Related activities: case discussion based on readings on applied aspects of cooperative communications, use of hand-on tutorials and problem solving

### Unit 5: Cognitive Networks and spectrum management

**Learning time:** 12h  
Theory classes: 4h  
Self study: 8h

**Description:**
* Cognitive Radios and Cognitive Network architectures  
* Cognitive cycle, spectrum sensing, decision, sharing and mobility  
* Routing algorithms, transport layer and cross layer solutions

**Related activities:**  
Related activities: case discussion based on readings on applied aspects of cognitive networks, use of hand-on tutorials and problem solving

### Unit 6: Cellular planning

**Learning time:** 47h  
Theory classes: 15h  
Self study: 32h

**Description:**
* Expected traffic and allocated resources  
* Frequency planning: fixed reuse, soft reuse and frequency partitioning  
* Handover schemes  
* Cell clusters  
* 2G planning: steps and examples  
* 3G planning: steps and examples  
* 4G planning: steps and examples
25% midterm control
25% final exam
10% each homework deliverable. Students will have to deliver five reports that should be done preferably working in pairs.

**Bibliography**

**Basic:**


**Others resources:**
Additionally technical papers (IEEE journals, but also operators/manufacturers reviews) will be assigned to students. Also 3GPP documents and RFC from IETF will be given.