Signal Processing in Communications

Academic Year: (2019 / 2020) **Review date: 02-04-2019**

Department assigned to the subject: Department of Signal and Communications Theory

Coordinating teacher: RAMIREZ GARCIA, DAVID

Type: Electives ECTS Credits : 6.0

Year : 1 Semester : 1

STUDENTS ARE EXPECTED TO HAVE COMPLETED

Those subjects required for the admission to the Master.

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

Students must possess the learning skills to enable them to continue studying in a way that will be largely self-directed or autonomous.

Systematic understanding of a field of study and mastery of the skills and methods of field.

Ability to perform critical analysis, evaluation and synthesis of new and complex ideas research associated with that.

Being able to make a critical analysis of technical and scientific documents in the field of Signal Processing and Communications.

Ability to apply knowledge of mathematics, statistics and science to the problems of Signal Processing and Communications.

Possessing the skills to design and conduct experiments and analyze and interpret data.

Handle with ease and critically fundamental design concepts of digital communication systems and their subsystems (capacity, source and channel coding, conditional entropy, multipulse, OFDM, spread spectrum, synchronization, equalization and channel estimation, diversity, spectral efficiency , LTE, adaptive load as QoS, algebraic coding, block and convolutional codes, concatenated coding and LDPC iterative decoding, ergodic capacity, active antennas, antenna arrays, broadband antennas, diplexers, filters, amplifiers, oscillators and mixers) able to analyze the performance of these systems and to make design decisions and implementation
- Acquire ability to design and analyze signal processing algorithms that made ¿¿the main functions of a digital receiver (synchronization, estimation / channel equalization, detection, decoding).
- Acquire ability to design and analyze complex communications systems that combine various kinds of signal processing algorithms.

DESCRIPTION OF CONTENTS: PROGRAMME

Chapter 1: Introduction
Chapter 2: Introduction to MIMO Systems
- 2.1: Fading
- 2.2: Capacity limits of MIMO systems
- 2.3: Diversity-multiplexing trade-off

Chapter 3: Review of detection and estimation
- 3.1: Estimation: LS, LMMSE, MMSE
- 3.2: Detection: Neyman-Pearson lemma, GLRT, UMPIT, LMPIT

Chapter 4: MIMO systems with spatial multiplexing
- 4.1: Detection in V-BLAST systems
- 4.2: Suboptimal detectors
- 4.3: Sphere decoding

Chapter 5: MIMO systems with space-time block coding
- 5.1: Design of space-time block codes (STBC)
- 5.2: Signal model for STBC
- 5.3: Orthogonal STBC (OSTBC)
- 5.4: Quasi-orthogonal STBC (QSTBC)

Chapter 6: Cognitive radio

6.1: Introduction
6.2: Spectrum sensing
6.3: Extensions: multiantenna and cooperative detectors

LEARNING ACTIVITIES AND METHODOLOGY

No collective consultation hours planned.

ASSESSMENT SYSTEM

Individual or group assignments performed during the course.

Convocatoria extraordinaria:
Individual assignments to retake those failed during the course.

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- Andrea Goldsmith Wireless communications, Cambridge University Press, 2005
- Arogyaswami Paulraj, Rohit Nabar, and Dhananjay Gore Introduction to Space-Time Wireless Communications, Cambridge University Press, 2008
- Erik G. Larsson and Petre Stoica Space-Time Block Coding for Wireless Communications, Cambridge University Press, 2008
- Mohinder Jankiraman Space-time codes and MIMO systems , Artech House, 2004
- Thomas M Cover and Joy A Thomas Element of Information Theory, John Wiley & Sons, 2006