Course guide
230601 - SIGPRO - Signal Processing

Last modified: 11/04/2025

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Optional subject).

Academic year: 2025 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: M. MERITXELL LAMARCA OROZCO

Others: Primer quadrimestre:
M. MERITXELL LAMARCA OROZCO - 10

PRIOR SKILLS

Completed at least two subjects of the area Signals, Systems, and Transforms
Completed at least one subject about Probability, Random Variables and Stochastic Processes

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Ability to process continuous variable signals using digital techniques.
2. Ability to characterize deterministic and random signals in time or space, and in the frequency domain.
3. Ability to analyze, model, identify and simulate linear systems, especially digital filters and adaptive systems.

4. Ability to apply information theory methods, adaptive modulation and channel coding, as well as advanced techniques of digital signal processing to communication and audiovisual systems.

Transversal:
5. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

7. 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
- Exercises and applications
- Laboratory work (three 2-hour sessions)
- Individual work and team work
- Assignments
- Short and extended answer tests (Partial and Final Exams)

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject:

Understanding the concepts and techniques of the field of statistical signal processing, and their application to problems arising from real applications.

Learning results of the subject:

Given several application contexts from multimedia and communications, the students develop their ability to digitally process, with linear systems and transforms, signals from those applications which are modelled as stochastic processes.

STUDY LOAD

Type	Hours	Percentage
Self study	86,0	68.80
Hours large group	39,0	31.20

Total learning time: 125 h

CONTENTS

1. Fundamentals of signal processing

Description:
- Introduction and applications
- Discrete-time signal processing
- Random variables and sequences

Full-or-part-time: 34h
Theory classes: 9h
Self study : 25h

2. Basic estimation theory

Description:
- Principles of estimation theory
- ML and MAP estimation

Full-or-part-time: 14h
Theory classes: 3h
Laboratory classes: 2h
Self study : 9h

3. Nonparametric spectrum estimation

Description:
- Periodogram and autocorrelation estimates
- Smoothing the periodogram. Applications

Full-or-part-time: 27h
Theory classes: 7h
Laboratory classes: 2h
Self study : 18h

4. Signal modeling and parametric spectral estimation

Description:
- Linear models of random processes
- AR-based spectral estimation. Applications

Full-or-part-time: 20h
Theory classes: 4h
Laboratory classes: 2h
Self study : 14h

5. Optimal Wiener filtering

Description:
- Optimal linear filters and predictors
- Adaptive filters. LMS algorithm.
- Applications

Full-or-part-time: 30h
Theory classes: 8h
Laboratory classes: 2h
Self study : 20h

GRADING SYSTEM

Final exam: 40%
Partial exams: 30%
Laboratory work: 20%
Assignments: 10%

BIBLIOGRAPHY

Basic:
- Hayes, M.H. Digital signal processing. 2nd ed. New York: McGraw Hill, 2012. ISBN 9780071635097.

Complementary:
- Manolakis, D.G.; Ingle, V.K.; Kogon, S.M. Statistical and adaptive signal processing: spectral estimation, signal modeling, adaptive filtering, and array processing. Boston: Artech House, 2005. ISBN 9781580536103.

RESOURCES

Other resources:
Teacher's material: notes, problem sets, laboratory guides