

230601 - SIGPRO - Signal Processing

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2019
Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: Climent Nadeu
Others: Meritxell Lamarca

Opening hours

Timetable: Tuesday and Thursday from 10:00 to 13:00

Prior skills

Advanced knowledge of Signals, Systems, and Transforms
Basic knowledge of Probability, Random Variables and Stochastic processes

Requirements

Two courses of the area Signals, Systems, and Transforms
At least one course 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.

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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

Total learning time: 125h	Hours large group:	39h	31.20%
	Self study:	86h	68.80%

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Content

<p>1. Fundamentals of signal processing</p>	<p>Learning time: 34h Theory classes: 9h Self study : 25h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Introduction and applications - Discrete-time signal processing - Random variables and sequences 	
<p>2. Basic estimation theory</p>	<p>Learning time: 14h Theory classes: 3h Laboratory classes: 2h Self study : 9h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Principles of estimation theory - ML and MAP estimation 	
<p>3. Nonparametric spectrum estimation</p>	<p>Learning time: 27h Theory classes: 7h Laboratory classes: 2h Self study : 18h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Periodogram and autocorrelation estimates - Smoothing the periodogram. Applications 	
<p>4. Signal modeling and parametric spectral estimation</p>	<p>Learning time: 20h Theory classes: 4h Laboratory classes: 2h Self study : 14h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Linear models of random processes - AR-based spectral estimation. Applications 	

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<p>5. Wiener filtering</p>	<p>Learning time: 30h Theory classes: 8h Laboratory classes: 2h Self study : 20h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Optimal linear filters and predictors - Adaptive filters. LMS algorithm. - Applications 	

Qualification system

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

Bibliography

Basic:

Hayes, M.H. Statistical digital signal processing and modeling. New York: John Wiley, 1996. ISBN 0471594318.

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.

Others resources:

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