

SUBJECT TEACHING GUIDE

G837 - Treatment of Multimedia Signals

Degree in Telecommunication Technologies Engineering
 First Degree in Telecommunication Technologies Engineering

Academic year 2024-2025

| 1. IDENTIFYING DATA | | | | | |
|----------------------------------|--|------------------|--------------------|------------------|--------------------------------------|
| Degree | Degree in Telecommunication Technologies Engineering First Degree in Telecommunication Technologies Engineering | | | Type and Year | Optional. Year 3 Optional. Year 3 |
| Faculty | School of Industrial Engineering and Telecommunications | | | | |
| Discipline | Subject Area: Transmission and Treatment of Signals | | | | |
| Course unit title and code | G837 - Treatment of Multimedia Signals | | | | |
| Number of ECTS credits allocated | 6 | Term | Semester based (2) | | |
| Web | http://gtas.unican.es/docencia/tsm | | | | |
| Language of instruction | Spanish | English Friendly | No | Mode of delivery | Face-to-face |

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| Department | DPTO. INGENIERIA DE COMUNICACIONES | | | | |
| Name of lecturer | JESUS PEREZ ARRIAGA | | | | |
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| Other lecturers | | | | | |

3.1 LEARNING OUTCOMES

- Applying tools and concepts of statistical signal processing to solving problems of detection, classification, estimation, prediction, modeling and optimal / adaptive filtering.
- Ability to solve problems of statistical signal processing through computer simulation.

4. OBJECTIVES

Solving simple problems of classification and detection.

Estimation of power spectral density of stochastic processes.

Solving basic parameter estimation problems.

Solving basic problems of optimal filtering, channel equalization, system identification, linear prediction, noise and interference cancellation.

Using Matlab to solve statistical signal processing problems.

6. SUBJECT PROGRAM

CONTENTS

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| 1 | STOCHASTIC PROCESSES AND RANDOM VECTORS. WSS and ergodic processes. Correlation function. Power spectral density. Gaussian processes, ARMA processes. Probability mass function and probability density function of random vectors. Correlation and covariance matrices. Gaussian random vectors. |
| 2 | SPECTRAL ANALYSIS. Spectral analysis of signals. Power spectrum estimation of random signals. Classical methods: Periodogram, Blackman-Tuckey method, Bartlett method, Welch method. Parametric methods: AR model. Yule-Walker method. Linear prediction. |
| 3 | OPTIMAL FILTERING AND ADAPTIVE FILTERING. Wiener filter. Normal equations. Steepest descent algorithm. LMS algorithm. Application to system identification, channel equalization, linear prediction, noise and interference cancellation and channel estimation. |
| 4 | PARAMETER ESTIMATION. Bias, variance and mean squared error. Maximum likelihood estimation, least squares estimation and method of moments estimation. Bayesian estimation. MAP estimation. |
| 5 | CLASSIFICATION AND DETECTION. Decision rule. Type of errors. Probability of error, detection and false alarm. ROC curve. Likelihood ratio test (LRT). Generalized LRT. Detection criteria. Detection of signals in noise. M-ary classification. Discriminant functions. |

| 7. ASSESSMENT METHODS AND CRITERIA | | | | |
|---|--------------|-------------|-----------|---------------|
| Description | Type | Final Eval. | Reassessn | % |
| Final exam and quizzes The online evaluation of the final exam and quizzes is foreseen in the event that a new health alert for COVID-19 makes it impossible to carry out the regular evaluation. | Written exam | Yes | Yes | 60,00 |
| Quizzes. | Written exam | No | No | 40,00 |
| | | No | No | 0,00 |
| TOTAL | | | | 100,00 |
| Observations | | | | |
| <p>The assessment consists of a set of quizzes and a final exam. If the final exam score is equal to or greater than 4 out of 10, the final grade is the weighted average of the quizzes (40%) and final exam (60%). If the final exam score is less than 4 out of 10, the student fails the subject.</p> <p>The online evaluation of the final exam and quizzes is foreseen in the event that a new health alert for COVID-19 makes it impossible to carry out the regular evaluation.</p> | | | | |
| Observations for part-time students | | | | |
| <p>The student must score at least 5 out of 10 in the final exam to pass the course.</p> <p>The online evaluation of the final exam is foreseen in the event that a new health alert for COVID-19 makes it impossible to carry out the regular evaluation.</p> | | | | |

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

S. M. Kay, Fundamentals of statistical signal processing, vol. I, Estimation theory, Prentice Hall, 1993

S. M. Kay, Fundamentals of statistical signal processing, vol. II, Detection theory, Prentice Hall, 1998

P. Stoica, R. Moses, Introduction to spectral analysis, Prentice Hall, 1997