

## Course guide

# 280597 - 280597 - Marine Data and Information Processing Using Matlab

Last modified: 09/05/2023

|                            |                                                                                                                                                                                                                                                                                          |                           |
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| <b>Unit in charge:</b>     | Barcelona School of Nautical Studies                                                                                                                                                                                                                                                     |                           |
| <b>Teaching unit:</b>      | 707 - ESAII - Department of Automatic Control.                                                                                                                                                                                                                                           |                           |
| <b>Degree:</b>             | BACHELOR'S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Optional subject).<br>BACHELOR'S DEGREE IN NAUTICAL SCIENCE AND MARITIME TRANSPORT (Syllabus 2010). (Optional subject).<br>BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject). |                           |
| <b>Academic year:</b> 2023 | <b>ECTS Credits:</b> 6.0                                                                                                                                                                                                                                                                 | <b>Languages:</b> Catalan |

## LECTURER

|                               |                                                                        |
|-------------------------------|------------------------------------------------------------------------|
| <b>Coordinating lecturer:</b> | JORDI FONOLLOSA MAGRINYA                                               |
| <b>Others:</b>                | Segon quadrimestre:<br>JORDI FONOLLOSA MAGRINYA - DT, GESTN, GNTM, GTM |

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

### Specific:

CE3. Basic knowledge on using and programming computers, operating systems, databases and computer programs for engineering applications.

CE4.GESTN. Basic knowledge on using and programming computers, operating systems, databases and software with application in the field of naval engineering technology.

### Generical:

CG8.GEN. ABILITY TO IDENTIFY AND SOLVE PROBLEMS IN THE FIELD OF ENGINEERING

### Transversal:

06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

## TEACHING METHODOLOGY

Lecturing with student participation.  
Project based learning. Learning by doing.  
Lab work. Programming work.

## LEARNING OBJECTIVES OF THE SUBJECT

The main objective is to provide students with the ability to use high-level languages such as Matlab or Python. The goal is being able to solve problems in the field of engineering, in particular, for data and information processing in the field of nautics.

At the end of the course the student should be able to:

- Import and export data to the programming environment.
- Make use of statistical tools and understand the corresponding concepts.
- Process digital signal as time series.
- Perform image processing.
- Make use of machine learning techniques and prediction models.

## STUDY LOAD

| Type              | Hours | Percentage |
|-------------------|-------|------------|
| Guided activities | 18,0  | 12.00      |
| Self study        | 90,0  | 60.00      |
| Hours large group | 12,0  | 8.00       |
| Hours small group | 30,0  | 20.00      |

**Total learning time:** 150 h

## CONTENTS

### Introduction to programming environment

**Description:**

Object and scope of the course. Programming environment. Matlab. Types of variables, graphical environment, file management, libraries and basic functions.

**Full-or-part-time:** 9h

Theory classes: 1h

Practical classes: 3h

Self study : 5h

### Probability and Statistics

**Description:**

Make use of the Matlab environment to solve probability and statistical problems. Simulation, basic probability and conditional probability. Discrete and continuous random variables. Visualization of data sets, Measurements of centrality and dispersion. Distributions.

**Full-or-part-time:** 19h

Theory classes: 1h

Practical classes: 4h

Guided activities: 2h

Self study : 12h

### Fitting and interpolation

**Description:**

Fitting a curve to data. Fit linear and nonlinear models to data. Linear regression. Evaluation of goodness of fit. Nonlinear regression. Data interpolation. Linear interpolation. Nonlinear interpolation

**Full-or-part-time:** 20h

Theory classes: 2h

Practical classes: 4h

Guided activities: 2h

Self study : 12h

### title english

#### Description:

Building a simple AM model in Simulink. Creation of a subsystem. Visualization of a signal in the domains of time and frequency. Build a complete model using the Communication System Toolbox and become familiar with the different visualization tools within the toolbox. Analyze the BER performance of a complete communications system. Add channel effects and recall blocks to test receiver performance.

#### Full-or-part-time: 20h

Theory classes: 2h

Practical classes: 4h

Guided activities: 2h

Self study : 12h

### Image processing

#### Description:

Basic image import, processing and export. Detect and measure objects in an image. Object Detection in a Cluttered Scene Using Point Feature Matching.

#### Full-or-part-time: 21h

Theory classes: 2h

Practical classes: 5h

Guided activities: 2h

Self study : 12h

### Machine Learning techniques

#### Description:

Reduction of dimensionality. Supervised and unsupervised learning techniques. Validation techniques. Using Python and its libraries. Automatic classification of ships according to their characteristics. Design and evaluation of prediction models.

#### Full-or-part-time: 23h 30m

Theory classes: 2h

Practical classes: 5h

Guided activities: 2h

Self study : 14h 30m

## GRADING SYSTEM

The final grade ( $N_{final}$ ) is the sum of the following grades:

$$N_{final} = 0,45 N_T + 0,35 N_{ac} + 0,2 N_p$$

$N_{pf}$ : grade of proposed exercises

$N_{ac}$ : continuous assessment.

$N_p$ : programming project

The final mark will include the exercises proposed outside classe ( $N_{pf}$ ), exercises proposed in class ( $N_{ac}$ ), and the development of a programming project ( $N_p$ )

Re-evaluation: According to the regulations of the FNB, there will be a re-evaluation test that will consist of a global examination of the course. Students with a final grade between 3.0 and 4.9 may take this re-evaluation test. The maximum rating of the re-evaluation is 5.0



## BIBLIOGRAPHY

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### Basic:

- Attaway, Stormy. MATLAB® : a practical introduction to programming and problem solving [on line]. Fourth edition. Kidlington, Oxford, UK: Butterworth-Heinemann is an imprint of Elsevier, [2016] [Consultation: 28/07/2022]. Available on: <https://www.sciencedirect-com.recursos.biblioteca.upc.edu/book/9780128045251/matlab>. ISBN 0128045256.
- García de Jalón, J.; Rodríguez, J. Ignacio. Aprende Matlab 7.0 como si estuviera en primero [on line]. Madrid: Universidad Politécnica de Madrid. Escuela Técnica Superior de Ingenieros Industriales, 2005 [Consultation: 23/10/2020]. Available on: <http://ocw.uniovi.es/file.php/146/T4MaterClase/MATLAB/matlab70primero.pdf>.
- Proakis, John G; Salehi, Masoud. Communication systems engineering. 2nd ed. Upper Saddle River: Prentice Hall, 2002. ISBN 0130950076.
- Theodoridis, Sergios. Machine learning : a bayesian and optimization perspective [on line]. 2nd edition. London: Elsevier Academic Press, 2020 [Consultation: 12/07/2022]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=6118601>. ISBN 9780128017227.