Course guides
280689 - 280689 - Marine Data and Information Processing Using Matlab

Unit in charge: Barcelona School of Nautical Studies
Teaching unit: 707 - ESAII - Department of Automatic Control.
Degree: BACHELOR'S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN NAUTICAL SCIENCE AND MARITIME TRANSPORT (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).
Academic year: 2020  ECTS Credits: 4.5  Languages: Catalan

LECTURER
Coordinating lecturer: Fonollosa Magrinya, Jordi
Others: Segon quadrimestre:
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**

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>10,0</td>
<td>8.89</td>
</tr>
<tr>
<td>Guided activities</td>
<td>10,0</td>
<td>8.89</td>
</tr>
<tr>
<td>Hours small group</td>
<td>25,0</td>
<td>22.22</td>
</tr>
<tr>
<td>Self study</td>
<td>67,5</td>
<td>60.00</td>
</tr>
</tbody>
</table>

**Total learning time:** 112.5 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:**

**Full-or-part-time:** 20h
Theory classes: 2h  
Practical classes: 4h  
Guided activities: 2h  
Self study: 12h
### Building a simple AM model in Simulink

**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

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### 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

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### 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

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### GRADING SYSTEM

The final grade (Nfinal) is the sum of the following grades:

\[ N_{\text{final}} = 0.5 \, N_{\text{pf}} + 0.5 \, N_{\text{ac}} \]

**Npf:** final test grade.  
**Nac:** continuous evaluation.

Continuous assessment consists of a series of tasks performed during the course. The final test consists of short exercises associated with the learning objectives of the course. The final test can be replaced with a series of practical works during the course.

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

Basic: