Course guides
250578 - PERCREMSEN - Remote Sensing and Sensors

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.
Degree: BACHELOR’S DEGREE IN MARINE SCIENCE AND TECHNOLOGY (Syllabus 2018). (Compulsory subject).
Academic year: 2020  ECTS Credits: 6.0  Languages: Catalan, Spanish

LECTURER
Coordinating lecturer: JORDI PRAT TASIAS
Others: MARIANO LOPEZ GARCIA, JORDI PRAT TASIAS

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
13388. To know and apply the lexicon and concepts of the Marine Sciences and Technologies and other related fields.
13401. Apply spatial and cartographic representation techniques for different environments and scales.
13403. Develop a conceptual framework to address the sustainability of the marine environment and the related socio-economic activities at different scales, explaining the effects of climate change.

General:
13384. Apply knowledge and academic experience to the control and monitoring of the marine environment and its coastal boundary, using the state-of-the-art tools in the Marine Sciences and Technologies.
13386. Encompass and teach studies in the different research lines that converge in Marine Sciences and Technologies.
13387. Combining preservation with economic activity within the framework of current legislation promoting the development of a social and environmental awareness.

TEACHING METHODOLOGY

The course consists of 2.3 hours per week of classroom activity (large size group) and 1.2 hours weekly with half the students (medium size group).

The 2.3 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 1.2 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.
LEARNING OBJECTIVES OF THE SUBJECT

In this course, students will be provided with basic knowledge about the use of sensors in remote locations for oceanographic studies at different spatial and temporal scales. The basic concepts for the development of this type of sensors will be shown, such as their autonomy and communications, and practical applications made in international projects and initiatives will be presented. Satellite exploration and its principles will be described, such as the interaction of the electromagnetic spectrum with the atmosphere and water, the spectral properties of the earth, ocean, atmosphere and vegetation, as well as different in situ observation platforms.

1.- Understand the basic concepts of remote sensing: units, spatial and spectral resolution.
2.- Know the existing relationships between the physical / chemical characteristics of the marine environment and the living resources and the remote sensing techniques.
3.- Know the characteristics and types of remote sensing sensors both active and passive.

This subject is focused on showing, familiarizing and training students with techniques of observation, monitoring, acquisition and treatment of marine data, as well as modeling techniques, physical and numerical, which allow to characterize practically all of the real problems that will have to address in the professional practice and that will allow the students to finish a generic training cycle but with advanced and transversal knowledge in Sciences and Technologies of the Sea.

The basic concepts of perception systems used for the measurement of different hydrographic properties and dynamic properties of seas and oceans will be introduced. A generic study of sensors will be carried out, introducing terminology and fundamentals of classical sensors. The specialized sensors that are part of the oceanographic instrumentation systems will be studied. More complex remote sensing systems will be described where multiple sensors are integrated into various types of marine research platforms and satellite exploration and its principles will be introduced. At the end of the course students will have been trained in the knowledge of various technological devices that are a substantial part of Marine Technologies as well as techniques for measuring and acquiring data on various hydrographic and dynamic properties of the marine environment.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

Introduction to electronic measurement systems

Description:
- Description of analog and digital measurement chains
- Introduction of basic concepts and terminology

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m
**Sensor characteristics**

**Description:**
- Basic characteristics of the sensors
- Static characteristics
- Dynamic characteristics

**Full-or-part-time:** 7h 11m
Theory classes: 3h
Self study: 4h 11m

---

**Sensors for measuring temperature, force and displacement**

**Description:**
- Introduction to classic sensors.
- Force, weight and pressure sensors.
- Temperature sensors.
- Displacement sensors.

Problems 1
Lab 1

**Full-or-part-time:** 26h 24m
Theory classes: 6h
Practical classes: 3h
Laboratory classes: 2h
Self study: 15h 24m

---

**Sensors for measuring hydrographic properties**

**Description:**
- Study of sensors for the measurement of hydrographic properties. - CTD, Turbidimeters, Hydrocarbon detection sensors, Dissolved oxygen sensors

Problems 2
Lab 2

**Full-or-part-time:** 36h
Theory classes: 6h
Practical classes: 4h
Laboratory classes: 5h
Self study: 21h

---

**Sensors for measuring dynamic properties**

**Description:**
- Study of sensors for the measurement of dynamic properties.
- Electromagnetic current meters and acoustic current meters, Acoustic Doppler current profiling machines, Tide and swell meters

Problems 3
Lab 3

**Full-or-part-time:** 38h 24m
Theory classes: 6h
Practical classes: 4h
Laboratory classes: 6h
Self study: 22h 24m
Hydrophones and Geophones

Description:
- Study of hydrophones as devices to record underwater acoustic effects and their applications in ocean observation (marine mammal monitoring, port security, among others) and environmental monitoring (ship and navigation noises, dike monitoring, acoustic impact of marine constructions, etc. - Study of submarine seismic detection equipment and its applications.

Problems
The B

Full-or-part-time: 14h 23m
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 2h
Self study : 8h 23m

Sensor systems in surface and subsurface anchors

Description:
- Study of sensor systems that are integrated into anchored platforms when measurements are needed in a fixed location for long periods of time.

Problems 5

Full-or-part-time: 9h 36m
Theory classes: 2h
Practical classes: 2h
Self study : 5h 36m

Introduction to satellite scanning systems

Description:
Introduction to the study of sensors located in satellites for the measurement of some properties of the ocean surface from space.

Full-or-part-time: 4h 48m
Theory classes: 2h
Self study : 2h 48m

GRADING SYSTEM

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.
BIBLIOGRAPHY

Basic:

Complementary:
- Evans, B.W. Arduino programming notebook [on line]. Castellón de la Plana: Ardumanía, 2011 [Consultation: 23/03/2021]. Available on: https://mega.nz/file/n8ImBTAQ#NNX3BgQu-U58DG31Ocbb8HwY999f46Wr3zS6svc1UM.