

Course guide 250578 - PERCREMSEN - Remote Sensing and Sensors

	Last modified: 30/05/2024
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: 2024	ECTS Credits: 6.0 Languages: Spanish
LECTURER	
Coordinating lecturer:	MARIANO LOPEZ GARCIA

Others: MARIANO LOPEZ GARCIA, DANIEL MIHAI TOMA

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.

Generical:

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 subject is divided into:

-Classes of theory and problems in which the different topics will be exposed, the fundamental concepts will be explained and problems will be realized where to apply the acquired knowledge.

-Laboratory classes where some of the theoretical knowledge presented will be illustrated in a practical way.

Detailed teaching material will be used through the Atenea virtual campus, both at the theoretical and laboratory practice level.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.



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

Туре	Hours	Percentage
Self study	90,0	60.00
Hours large group	40,0	26.67
Hours small group	20,0	13.33

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, errors and definitions
- 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 (Strain gauge, piezoelectrics)
- Temperature sensors (RTDs, thermistors, thermocouple, semiconductor-junction 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, electrical conductivity meter, 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 (geophone).

Problems 4. Lab 4

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

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 (satelitat oceanography).

- Remote comunications via satellite

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

Work presentation

Full-or-part-time: 9h 36m Laboratory classes: 4h Self study : 5h 36m



GRADING SYSTEM

The assessment schedule and the Grading Method will be approved before the start of the course. The qualification of the subject will obtain from the qualifications of the evaluation of different activities and of the corresponding qualifications to the practices of laboratory. All activities as well as laboratory practices are mandatory. The activities to be evaluated will be the following: Partial control, CP, (30%) Course work, TC, (15%) Final control, CF, (30%) The evaluation of the laboratory practices, LAB, will correspond to the weighted average of such activities and will be equivalent to 25% of the final grade. FINAL NOTE = $0.3 \times CP + 0.3 \times CF + 0.15 \times TC + 0.25 \times LAB$ There will be the possibility of a unique recovery (re-evaluation) of theory part of the course with the realization of a global test.

BIBLIOGRAPHY

Basic:

- De Silva, C.W. Control sensors and actuators. Englewood Cliffs [N.J.]: Prentice-Hall, 1989. ISBN 0131717456.
- Norton, Harry N. Sensores y analizadores. Barcelona: Gustavo Gili, 1984. ISBN 842521193X.

Complementary:

- Webster, J.G.; Eren, H. (eds.). Measurement, instrumentation and sensors handbook : electromagnetic, optical, radiation, chemical, and biomedical measurement [on line]. 2nd ed. Boca Raton: CRC Press, 2014 [Consultation: 17/03/2021]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1407945. ISBN 9781138072183.

- Raizer, V. Optical remote sensing of ocean hydrodynamics. Boca Raton: CRC Press, 2019. ISBN 9780367656461.

- Martin, S. An introduction to ocean remote sensing [on line]. 2nd ed. Cambridge: Cambridge University Press, 2014 [Consultation: 03/02/2021]. Available on: <u>https://doi.org/10.1017/CB09781139094368</u>. ISBN 9781107019386.

- Evans, B.W. Arduino programming notebook [on line]. Castellón de la Plana: Ardumanía, 2011 [Consultation: 23/03/2021]. Available on: <u>https://mega.nz/file/n8ImBTAQ#NNX3BgQu-U58DG310cbb8HwY999Fl46Wr3zS6svc1UM</u>.