Geographic Information Systems and Gnss (250565)

General Information

School	ETSECCPB
Departments	Departament d'Enginyeria Civil i Ambiental (DECA)
Credits	6.0 ECTS
Programs	GRAU EN CIÈNCIES I TECNOLOGIES DEL MAR (pla 2018)
Course	2025/26

Main teaching language at each group

- Group 11Q2 Catalan (Q2)
- Group 12Q2 Catalan (Q2)

Faculty

Responsible Faculty: Jose Antonio Gili Ripoll, Carolina Puig Polo
Faculty: Jose Antonio Gili Ripoll, Maria De Las Nieves Lantada Zarzosa, Francisco Javier Muñoz Capilla, Carolina Puig Polo

Objectives of Education

This subject will introduce, in a conceptual and practical manner, geographic information systems and the use of high precision location or geo-positioning systems such as GNSS, applied to mapping tasks, topographic or cadastral surveys and to marine and coastal management.

1.- Obtain, process, represent and interpret material from various sources (in-situ, remote and remote sensing systems), following the standardized criteria (spatial reference systems and cartographic / bathymetric projections).
2.- Interpret material from various sources (in-situ, remote and remote sensing systems) for ecological, environmental and territorial planning, classification based on land uses and land monitoring.
3.- Interrelate geographic information, for example, starting from several sources to perform an analysis using geographic information systems (GIS) in the field of Marine Sciences.

This is where students are expected to obtain a vision of real environmental problems in the marine environment from a perspective that combines, on the one hand, chemistry and biology, as well as the mathematical techniques to address these problems (Marine Ecology, Ecosystems and Productive Processes) and, on the other, the tools of chemistry, biology and physics (Marine Pollution, Origin, Transport and Impacts), which are needed to solve common problems in coastal and platform waters.

This subject also includes applied techniques in the visualization, interpretation and resolution of the problems addressed in this same subject.

Competencies

Especific

To know and apply the lexicon and concepts of the Marine Sciences and Technologies and other related fields.
Establish a good practice in the integration of common numerical, laboratory and field techniques in the analysis of any problem related to the marine environment.
Apply spatial and cartographic representation techniques for different environments and scales.

Generic

Develop a professional activity in the field of Marine Sciences and Technologies.
Address in a comprehensive manner the analysis and preservation of the marine environment with sustainability criteria.
Develop a conceptual framework that links the scientific-technological and management aspects for marine resources, explaining the interactions with marine infrastructures and management plans in coastal areas.
Combining preservation with economic activity within the framework of current legislation promoting the development of a social and environmental awareness.

Total hours of student work

		Hours	Percentage
Supervised Learning	Large group	30.0 h	50.00 %
	Medium group	24.0 h	40.00 %
	Laboratory classes	6.0 h	10.00 %
	Guided Activities	0.0 h	0.00 %
Self Study		90.0 h	

Contents

Introduction

What are GIS and GNSS used for?

Coordinate Reference Systems

Geoid and ellipsoid. Coordinate systems. Geodetic and altimetric networks. Sea reference levels and mesurament methods.
Cartographic projections
Exercises
LAB 1. Introduction to the GIS, coordinate reference systems

Specific Objectives

Know the reference systems used in cartography and the different reference levels of the sea.

Geographic Information Systems

Data structure
Concepts of relational databases. Entity-relationship model. Primary and external keys. Integrity rules. Data relationship type. SQL queries
3D data structure
GIS tools and techniques for combining vector maps and rasters, using topological properties of connectivity, proximity, inclusion, neighborhood, etc. Vector and raster spatial analysis tools with different quantitative or qualitative variables, which are necessary for decision making.
Geoprocessing exercises
LAB. Data structure
LAB. Databases
LAB. Geoprocessing 1 and Geoprocessing 2

Specific Objectives

Organize the information in an optimized and related way in a relational database, and make inquiries in it later.
From a series of initial maps, obtain thematic maps derived using GIS spatial analysis tools, necessary for making decisions.

Capture Techniques Acquisition

GNSS
CAMP 1. RTK
CAMP 2. DGPS
LAB. Processing of 3D data
LIDAR (aerial and terrestrial)
CAMP 3. Acquisition of data obtained with LIDAR terretre
LAB. LIDAR data processed
Photogrammetry applied to massive data capture
FIELD 4. Photogrammetric acquisition with Dron
LAB. Photogrammetric processing
Exercises

Teaching Methodology

The course consists of 2 hours per week of classroom activity (large size group) and 2 hours weekly with half the students (medium size group).

The 2 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 2 hours in the small size groups is devoted to the realization of practical activities that can be capturing data outside of the class or processing the data in the computer room. The objective of these practical activities is to consolidate the general and specific learning objectives.

The language in which the course is taught will depend on the teacher. The subject of coordinate reference systems and capture techniques: LIDAR and Photogrammetry will be taught in Catalan, the rest in Spanish. The language of the exam questions will correspond to the language of instruction.

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.

Grading Rules

(*) The evaluation calendar and grading rules will be approved before the start of the course.

The final grade (Nf) is the average between the Exams Note (Ne) and the Practical activity Note (Np)

Exams Note, Ne: Npac1 = Test Note continuous assessment 2, half quarter Npac2 = Note test continuous evaluation 3, in this last test all the concepts not evaluated in the PAC1 will be evaluated. Ne (Exams Note): Ne = 0.5 * Npac1 + 0.5 * Npac2 Now, students with a Ne less than 5 have the option to opt for re-evaluation as long as they have the part of Practice of the subject passed and presented a minimum of 80% of the practical reports. # Note of practical activities, Np: problems, questionnaires, deliveries and work practices of both group and individual, of an additive and formative nature, carried out during the course, normally outside the classroom. Note Np integrates exercises done in the classroom or at home, practices reports, questionnaires made by Atenea, work carried out during field and laboratory practices (including assistance), and final deliveries. Final note, Nf: Ne is the result of an individual assessment of the student, while the Np is, in large part, a result of group work and outside the classroom. if Ne> = 5 and Np> = 5 then Nf = max (Ne, Np) * 0.8 + min (Ne, Np) * 0.2 well yes Ne <5 or Np <5 then Nf = min (Ne, Np) * 0.8 + max (Ne, Np) * 0.2 Criteria for qualification and admission to the re-evaluation: Students suspended to the ordinary assessment that have been submitted regularly to the evaluation tests of the subject suspended will have the option to perform a proof of re-evaluation in the period set in the academic calendar. Students who have already passed the qualification as not yet submitted may not be submitted to the re-evaluation test of a subject. The maximum grade in the case of submitting to the re-assessment exam will be five (5.0). The non-attendance of a student summoned to the test of re-evaluation, celebrated in the fixed period will not be able to give rise to the accomplishment of another test with later date. Extraordinary assessments will be made for students who have not been able to carry out any of the continuous assessment tests because of their proven force majeure. These tests must be authorized by the corresponding head of studies, at the

request of the professor responsible for the subject, and will be carried out within the corresponding teaching period.

Test Rules

Failure to perform a laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

Office Hours

Attendance times will be announced on the first day of the course

Bibliography

Basic

- Lekkerkerk, H.-J. GPS handbook: for professional GPS users. Emmeloord: CMedia Productions, 2007. ISBN 9789081275415.
- Heritage, G.L; Large, A.R.G. Laser scanning for the environmental sciences. Chichester, UK ; Hoboken, NJ: Wiley-Blackwell, 2009. ISBN 9781405157179.
- Burrough, P.A.; McDonnell, R.A. Principles of geographical information systems. 3rd ed. Oxford: Oxford University Press, 2015. ISBN 9780198742845.
- Leick, A.; Rapoport, L.; Tatarnikov, D. GPS satellite surveying. 4th ed. New York: John Wiley & Sons, 2015. ISBN 9781118675571.

Complementary

- Núñez-García, A.; Valbuena, J.L.; Velasco, J. GPS: la nueva era de la topografía. Madrid: Ediciones de las ciencias sociales, 1992. ISBN 8487510310.