Course guide
390439 - SDM - Sensors and Digital Mapping in Agriculture and Environmental Sciences

Last modified: 20/01/2026

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit: 745 - DEAB - Department of Agri-Food Engineering and Biotechnology.

Degree: BACHELOR'S DEGREE IN BIOSYSTEMS ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN AGRONOMIC SCIENCE ENGINEERING (Syllabus 2018). (Optional subject).

Academic year: 2025 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: Fran Garcia

Others: Lydia Serrano

REQUIREMENTS

You will need to have taken the Geomatics course to have basic knowledge of QGIS.

TEACHING METHODOLOGY

The learning methodology will be based on active learning where students are constantly applying the acquired knowledge, with a Project-Based Learning (PBL) approach and using real data provided by agents from the agro-industry and agro-environmental sectors.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, the student will be able to:
- Select appropriate measurement and data acquisition instrumentation for the optimization of agro-environmental processes.
- Operate different sensors (soil, spectral, etc.) for soil and vegetation characterization.
- Process georeferenced data acquired in the field (point samples, remote sensing images, etc.) to generate precision cartography for management support.
- Interpret the spatial variability of acquired data and resulting maps obtained through different data interpolation techniques.
- Work in multidisciplinary teams to solve a real agronomic or environmental management use case.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	75.00
Practical classes	30,0	25.00

Total learning time: 120 h

CONTENTS

Fundamentals of remote sensing for plant and soil monitoring

Description:
In this unit we work:
- Introduction and classification of the sensors used to monitor vegetation and soil in agri-environmental applications
- The electromagnetic spectrum and the interaction of light-matter
- Optical sensors
- Electromagnetic sensors for soil monitoring and mapping
- Interpret the error introduced in the data acquired in the field

Related activities:
Activity 1: Theory classes
Activity 2: Field practices for taking vegetation samples with optical sensors. Comparison and interpretation of spectral signatures

Full-or-part-time: 18h
Theory classes: 3h
Practical classes: 5h
Self study : 10h

Data analysis and interpolation

Description:
In this content we work:
- Pre-processing field data
- Exploratory analysis of geospatial data
- Introduction to different methods of data interpolation

Related activities:
Activity 1: Theory classes
Activity 2: Pre-processing and preparation of real data
Activity 3: Interpolation of geospatial data acquired under real conditions

Full-or-part-time: 34h
Theory classes: 5h
Laboratory classes: 9h
Self study : 20h

Map and cartography generation from field data

Description:
In this content we work:
- Data classification systems and generation of thematic maps
- Representation of information based on maps
- Main uses of the maps generated for agricultural or environmental management

Related activities:
Activity 1: Theory classes
Activity 2: Resolution of use cases with real data
Activity 3: Development of the case study that will become the final work of the course (N2)

Full-or-part-time: 23h
Theory classes: 3h
Practical classes: 5h
Self study : 15h

GRADING SYSTEM

The grade will be based on 3 grades:
1) The grade of the final exam
2) The grade of the delivery of a work (type technical report) that will be developed between the sessions in class and the autonomous work and will deal with a real case study in which the student will receive some data and will have to develop the project, the analysis and the interpretation of the results.
3) Attendance to the theory and practice sessions will have a weight in the final grade.

N: Final Grade
N1: Exam
N2: Final work grade
N3: Assistance

N=0.3*N1 + 0.6*N2+ 0,1*N3

BIBLIOGRAPHY

Basic:
- Oliver, Margaret A.; Webster, Richard. Basic Steps in Geostatistics: The Variogram and Kriging. 2015. ISBN 978-3-319-15864-8.
- OLIVER, M.A., WEBSTER, R.. "A tutorial guide to geostatistics: Computing and modelling variograms and kriging". Catena (Giessen), vol. 113 [on line]. pp. 56-69Available on: 10.1016/j.catena.2013.09.006.
- Bernhardsen, T.. Geographic Information Systems. An Introduction. 3rd Edition. John Wiley & Sons, Inc., New York, 2002.

Complementary:
- Skidmore, A. y Prins, H.. Environmental modelling with GIS and remote sensing. Taylor & Francis, Basingstoke, 2000. ISBN 9780415241700.