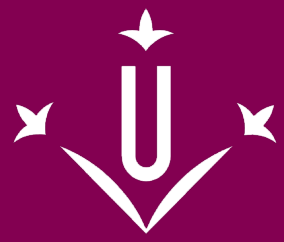

Universitat de Lleida

GUIA DOCENT

GEOGRAPHIC INFORMATION SYSTEMS AND REMOTE SENSING

Coordinació: MARTINEZ CASASNOVAS, JOSE ANTONIO

Any acadèmic 2017-18

Informació general de l'assignatura

Denominació	GEOGRAPHIC INFORMATION SYSTEMS AND REMOTE SENSING
Codi	11376
Semestre d'impartició	ANUAL AVALUACIÓ CONTINUADA
Caràcter	Grau/Màster: Màster Universitari Erasmus Mundus en Gestió Forestal i de Recursos Naturals al Mediterrani (MEDfOR) — Curs: 1 — Caràcter: OPTATIVA — Modalitat: Presencial
Nombre de crèdits ECTS	3
Grups	1GG
Crèdits teòrics	1.5
Crèdits pràctics	1.5
Coordinació	MARTINEZ CASASNOVAS, JOSE ANTONIO
Departament/s	MEDI AMBIENT I CIENCIES DEL SOL
Distribució càrrega docent entre la classe presencial i el treball autònom de l'estudiant	Lecture (concepts and examples): 1.6 ECTS including personal work Practical exercises: 1.4 ECTS including personal work
Informació important sobre tractament de dades	Consulteu aquest enllaç per a més informació.
Idioma/es d'impartició	English
Horari de tutoria/lloc	On demand

Professor/a (s/es)	Adreça electrònica professor/a (s/es)	Crèdits impartits pel profesor	Horari de tutoria/lloc
MARTINEZ CASASNOVAS, JOSE ANTONIO	j.martinez@macs.udl.cat	3	Building 3, 3rd floor, office 3.09, ETSEA

Informació complementària de l'assignatura

The course teaches basic techniques and methods for the representation and spatial analysis of land and territory (in the broadest sense), with the ultimate goal of problem solving and land planning.

Remote sensing is the science that involves the detection, identification, classification and analysis of the ground cover, land use and phenomena occurring at the Earth surrface through remote sensors installed in airborne or space platforms. Meanwhile, Geographic Information Systems (GIS) is the science and technology oriented to manage, query, update, analyze and model spatial information generated through surveying methods and / or remote sensing, in an integrated manner.

GIS and remote sensing are based on the management of specific hardware and software. The use of these technologies is of great interest and application in other matters of the MsC degree, particularly those related to the mapping of land use and vegetation cover, management of forest systems, territorial and environmental planning, forest fires, reforestation, analysis of changes in ground cover, landscape analysis, environmental impact assessment or watershed hydrologic analysis, among others.

In summary, the basic descriptors of the course are: Remote Sensing. Physical principles of remote sensing. Techniques of remote sensing data acquisition. Digital image processing. Geographic Information Systems. GIS data structures (Vector and Raster). Spatial analysis of land information.

Objectius acadèmics de l'assignatura

Knowledge objectives. A student who passes the subject must understand and demonstrate knowledge in:

- The role of GIS and Remote Sensing in the acquisition, processing and analysis of information from the territory for inventory, planning and management.
- The nature and the physical basis of remote sensing techniques and the advantages and limitations of remote sensing for use in studies of the territory.
- The image analysis techniques (visual interpretation and digital processing), for subsequent application in the resolution of individual cases of inventories of natural resources and environment.
- Modeling structures of information relating to the territory, both thematic and topographic (geometry + attributes) in GIS.
- The main techniques and analysis functions of GIS, for subsequent application in the resolution of individual cases of natural resource inventories and / or environmental studies.
- The main sources of information and other resources related to these geographic information technologies and their application to forestry.

Competències

Capacity objectives (competencies. A student who passes the subject must be able of:

- Applying the knowledge about data structures in the representation of land information when creating geodatabases.

- Define and apply the techniques of remote sensing image analysis (visual interpretation and digital processing) and technical analysis functions of geographic information using GIS software, to solve special cases of planning, analysis and forest management.
- Solve problems, aimed at planning and management of forest resources through the application of integrated remote sensing techniques and GIS, and know where to acquire additional knowledge on the subject.
- Prepare and present thematic mapping processes resulting from analysis of geographic information as a communication tool in planning and land management.

Continguts fonamentals de l'assignatura

Lessons

Lesson 1. INTRODUCTION TO GIS. Concept of geo-information and components.

Lesson 2. GEOINFORMATION CHARACTERISTICS. Geographic objects and phenomena. Measurement scales of the descriptive information.

Lesson 3. VECTOR DATA MODEL. Types of GIS vector structures: topological and "shapefile". GIS vector analysis: selection of attributes and location, geo-table join, union and intersection.

Lesson 4. RASTER DATA MODEL (regular grid). Representation of continuous variables and discrete variables. Rasterization and vectorization. Spatial resolution. Operations analysis: local, focal, zonal and global.

Lesson 5. ANALYSIS OF DIGITAL ELEVATION MODELS. Importance of MDE in the terrain analysis. Calculation of slopes, directions, curvatures, analytical shading, drainage, drainage basins and visibility analysis.

Lesson 6. INTRODUCTION TO REMOTE SENSING. Electromagnetic energy: nature and sources. Electromagnetic spectrum. Color theory. Interactions of electromagnetic energy with matter. Effect of atmospheric dispersion.

Lesson 7. SPECTRAL FEATURES OF THE EARTH'S SURFACE. Concept of spectral signature. Spectral signature of vegetation. Concept of vigour index. Soil spectral signature. Spectral signature of water.

Lesson 8. DIGITAL IMAGE PROCESSING CONCEPTS multispectral images. Contrast enhancement. Radiometric Corrections: effect of atmospheric dispersion. Geometric corrections. Calculation of vegetation indices. Types of vegetation indices. Indices based on the ratio of the IRP and R.

Lesson 9. CLASSIFICATION OF MULTISPECTRAL IMAGES. Spectral space concept. Types of image classification. Supervised classification: phases and accuracy assessment. Unsupervised classification.

Practical training

Exercise 1. ArcGIS Desktop - ArcMap settings and WMS Layers. Introduction to ArcGIS. Program and extensions. Access to free version and installation. Geoinformation concepts and visualization of layers. Visualization of layers on remote servers.

Exercise 2. Displaying and Querying of Geoinformation. Visualization of Vector and Raster layers. Properties. Symbology: single symbol, categories, grouped discrete variables, continuous variables. Attribute tables. Selection by attributes and by location.

Exercise 3. Creation and edition of vector layers in ArcGIS. Digitizing, table management and map layout creation.

Exercise 4. Geoprocessing operations with vector data. Dissolution of boundaries. Buffers and Clips. Intersection of layers.

Exercise 5. Fundamental characteristics of the Raster data model. Layer properties, pixel values, change of symbology. Rasterization of vector layer. Reclassification, neighbourhood statistics, mathematical and conditional operations with raster layers. Zonal statistics.

Exercise 6. Digital Elevation Models: Creation and extraction of topographic and hydrological attributes. Surface analysis: representation of contours, slope, aspect and exposition, hillshading. Extraction of hydrological information.

Exercise 7. Cartographic modelling in GIS: Mapping the possibility of vegetation regeneration after a forest fire.

Exercise 8. Remote sensing images: visualization and radiometric corrections.

Exercise 9. Image processing: calculation and analysis of vegetation indexes.

Exercise 10. Image processing: classification of multispectral images

Exercise 11. Case study.

Eixos metodològics de l'assignatura

Autonomous reading of lessons and online tests of the theoretical concepts.

Assisted practical exercises at computer room.

Pla de desenvolupament de l'assignatura

Deatailed information with calendar, timetable, room, lesson and exercises and due date of tests and exercises is available in the virtual campus of the subject.

Sistema d'avaluació

Assessment of the results of the practical exercises and one final exam.

Bibliografia i recursos d'informació

Basic

- Bernhardsen, T., 2002. Geographic Information Systems. An Introduction. 3rd edition. John Wiley & Sons, Inc., New York, 448 pp.
- Bosque, J., 2000. Sistemas de Información Geográfica. Rialp, S.A., Madrid, 452 pp.
- Chuvieco, E., 2010. Teledetección ambiental: La observación de la Tierra desde el Espacio, 2a Edición, Ariel, Barcelona.
- Domínguez García, F. - 1991 - Topografía general y aplicada . 10.ª edición**,** Editorial DOSSAT,Madrid, 823 pp.

- Domínguez García, F. - 1991 - Topografía abreviada. 10.ª edición**,** Editorial DOSSAT,Madrid, 448pp.
- Chueca, M.- 1982 – Topografia (tomos I,II), Editorial DOSSAT, Madrid.
- Martin Asin, F.- 1987 – Geodesia y Cartografia Matemática.- Instituto Geográfico Nacional, 422 pp.
- Lillesand, T.M. y Kiefer, R.W., 1999. Remote sensing and image interpretation, 4th Edition. John Wiley & Sons, Inc., New York, 736 pp.

Complementary

- Gómez Delgado, M., Barredo, J.I., 2005. Sistemas de Información Geográfica y evaluación multicriterio en la ordenación del territorio. 2ª Edición, Ra-ma, Madrid, 304 pp.
- Bonham-Carter, G.F., 1995. Geographic Information Systems for geoscientists: Modelling with GIS- Vol 13. Pergamon, Kidlington, 416 pp.
- Mather, P.M., 1999. Computer processing of remotely-sensed images. An introduction. 2ª Edición. John Wiley & Sons, Chichester, 306 pp.
- Skidmore, A. y Prins, H., 2000. Environmental modelling with GIS and remote sensing. Taylor & Francis, Basingstoke, 304 pp.
- Star, J.L., McGwire, K.C. y Estes, J.E. (coordinadores), 1997. Integration of Geographical Information Systems and remote sensing. Cambridge University Press, Cambridge, 248 pp.