Course Unit	Geographic Information Systems			Field of study	Environment										
Bachelor in	Renewable Energy Engineering			School	School of Technology and Management										
Academic Year	2023/2024	Year of study	3	Level	1-3	ECTS credits	6.0								
Type	Semestral	Semester	1	Code	9910-743-3101-00-23										
Workload (hours)	162	Contact hours	T -	TP 60	PL -	TC -	S -	E -	OT -	O -					

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): João Paulo Miranda Castro

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Recognize the possibilities and limitations of GIS in ecology and land planning
2. Handle computer applications taught in this class and learn other systems available in the market and export and import formats.
3. Choose and process remotely sensed imagery.
4. Understand the relational processes involving graphic and alphanumeric tables and be able to search geographically by attribute and location.
5. Use GNSS technology in surveys and navigation.
6. Realize the importance of availability of updated information through the internet.

Prerequisites

Before the course unit the learner is expected to be able to:
1. Understand phenomena of Ecology and Remote Sensing
2. Define processes of Cadastral, Surveying and Mapping and Thematic Cartography
3. Have notions of Statistics and Informatics

Course contents

Principles of GIS functioning, organization and application. Data input and output. Raster and vector formats. Relational databases: alphanumeric, spatial data and attribute data. Global Navigation Satellite System (GNSS): components, functioning, and practical applications. Platforms and sensors in Remote Sensing. Digital image processing. Application of GIS to ecology and land management.

Course contents (extended version)

1. 1. Introduction to GIS. History, definitions, and components.
   - Applications in forestry, agriculture and urban management
2. Geographic information. Coordinate systems. Spatial and attribute data.
3. Databases. Database management systems.
   - Data structure. Relational databases. GIS data structure models: vector and raster.
   - Topological and non-topological vector structures.
4. Acquisition, manipulation, analysis and production of information in GIS.
   - Georeferencing. Editing of geographic information. Spatial Information Analysis.
   - Spatial queries. Overlay and interception.
   - Slope, aspect, intervisibility, watershed delimitation, buffers, cost functions.
5. The light. Albedo.
   - Reflectance, transmittance and absorption.
   - Spectral signatures of vegetation, soil, water, ice and snow.
   - Passive and active sensors.
6. Scanning systems
   - Satellites and sensors: Landsat, Spot, Tiros/NOAA, Ikonos and SENTINEL.
   - Across-track scanners.
   - along-track scanners.
7. Characteristics of digital images. Filtration. Automatic classification, supervised and visual.
8. Global positioning systems (GPS). Components. Functioning. Practical applications.
9. Basics on Computer-Aided Design (CAD)
10. Digital elevation models (DEM). Construction and use.

Recommended reading

1. ARONOFF, S. 1989. Geographic information systems: A management perspective. WDL Publications, Ottawa, Canada.
2. BOSQUE SENDRA, J. 1997. Sistemas de información geográfica Madrid, Rialp, 2º edição corrigida, 451 p.
3. EASTMAN, J. R. 1992. IDRISI. Users Guide. Clark University, Worcester, 178 p.
4. LILLESAND, T. M. , KIEFER, R. W. 2000. Remote sensing and image interpretation, Fourth edition, John Wiley and sons. New York.
5. MAGUIRE, D. J. ; GOODCHILD, M. F. ; RHIND, D. W. 1991. Geographical Information Systems. Iongman Scientific ¿ Technical, New York.

Teaching and learning methods

Two theoretical-practical lessons of two hours each, in a classroom with computers (at least one for two students). Theoretical introduction during about 20 minutes followed by practical applicatons using tutorial models and supervision from the instructor. Some of the classes outdoors.

Assessment methods

1. Regular - (Regular, Student Worker) (Final)
   - Practical Work - 50% (Evaluation of technical reports, practice tests and portfolio (3 ECTS))
   - Final Written Exam - 50% (Final written examination (3 ECTS))
2. Non-regular - (Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 100% (Theory and practice written exam (6 ECTS))
3. Special - Finalists and Workers - (Student Worker) (Special)
   - Final Written Exam - 100% (Theory and practice written exam (6 ECTS))
4. Supplementary - (Regular, Student Worker) (Supplementary)
   - Final Written Exam - 100% (Theory and practice written exam (6 ECTS))

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Language of instruction

1. Portuguese
2. Portuguese, with additional English support for foreign students.

Electronic validation

João Paulo Miranda Castro	Ana Maria Alves Queiroz da Silva	José Carlos Rufino Amaro
19-10-2023	29-10-2023	31-10-2023

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