Academic Year/course: 2022/23

28317 - Geographical information systems

Syllabus Information

Academic Year: 2022/23
Subject: 28317 - Geographical information systems
Faculty / School: 103 - Facultad de Filosofía y Letras
Degree: 419 - Degree in Geography and Land Management
ECTS: 9.0
Year: 2
Semester: Annual
Subject Type: Compulsory
Module:

1. General information

1.1. Aims of the course

This subject is articulated around the achievement of four fundamental objectives:
a) Know the theoretical foundations of modeling and the application of the functions of analysis and visualization of GIS.
b) Describe the data models available in the GIS as well as their capabilities and limitations to represent the space geographically in a consistent manner.
c) Detail the composition and application of the main analytical and visualization functions of the GIS.
d) Acquire a medium level of management of a geographic information systems program.
The importance of these objectives derives from several main needs inherent to the performance of the activities of geographers: a) first, the complexity of problems of a geographical nature requires the use of several abundant and diverse data and information models, in form and content; b) on the other, the integration of the available digital information is efficiently carried out by GIS; c) finally, the SIG have functions specialized for the communication of results through cartography and other models of scientific visualization of data.

1.2. Context and importance of this course in the degree

This subject is part of the "Tools and techniques" module of the degree curriculum and provides methodological competences and techniques for the valuation, modeling and spatial analysis of geographic information. The comprehensive education of the geographer includes, together with concepts and theoretical contents, methodological knowledge and domain of technologies designed for the modeling and analysis of geographic information. This technical competence is fundamental for geographers, especially for those who are going to dedicate themselves to the professional practice from the training acquired in a degree in geography and spatial planning.

1.3. Recommendations to take this course

Basic knowledge of statistics and cartography. Management of Windows operating systems

2. Learning goals

2.1. Competences

Upon passing the subject, the student will be more competent to ...
CE6: Mastery of the conceptual and theoretical geographical foundations necessary to explain the contrasts spatial and temporal at different scales of analysis.
CE7: Management and application of basic techniques and tools in Geography to address territorial studies, environmental and landscape at different scales of analysis.
CE4: Mastery of the scientific terminology of the various branches of Geography and Territorial Planning.
CE10: Ability to develop knowledge in a professional context acquired.
CG2: Aptitude to interpret and critically evaluate the various information managed.
CG3: Ability to solve problems and make appropriate decisions and initiatives, both during his studies and in his future professional activity.
CG4: Management and mastery of Information and Communication Techniques.
CG7: Ability to work as a team.

2.2. Learning goals

The student, to pass this subject, must demonstrate the following results ...
-Describe the geographical space through the concepts and terms that are they use to build operational models in GIS. (It is related to the competence 1 and 3).
-To elaborate a conceptual model of a portion of the earth's surface and express it by means of a text and by graphics and conventions of the area of scientific modeling. (It is related to competence 1 and 3).
-Apply the principles of database construction to the organization and structuring of geographic data. (It is related to the competence 2).
-Use a GIS program to model a character problem territorial, using the principles and elements of the data models of the field of GIS and that can be applied through a GIS program. (Competences 5 and 6).
-Apply basic spatial analysis techniques appropriately to the context of its use. (It is related to competences 4 and 7).
-Manage a GIS software to carry out spatial analysis of the data of a GIS, with an average degree of difficulty. (It is related to the competence 2).
-Elaborate documents of medium complexity, composed of texts, maps, graphics and tables, to communicate in a clear and unequivocal way the specifications of design of a data model of a GIS application, as well as its results. (It is related to competences 4 and 6).
-Participate in a team with which to develop a focused work project in the use of geographic information systems. (It is related to competences 7 and 8).

2.3. Importance of learning goals

The learning results acquired in this subject are essential for the exercise of the profession of geographer and to model geographic problems in general. The elaboration of territorial plans of different types is usually understand the construction of a territorial model of the area or problem studied and the analysis of the data relevant. The distinctive feature of geographic analysis lies in the fundamental importance of localization, expressed in an absolute way, such as proximity, neighborhood, connection or with other topologies. The results of learning of this subject enable students to carry out modeling activities with solvency, spatial analysis and information visualization.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that he has achieved the expected learning results through the following evaluation activities:
First Call
a) Continuous evaluation system
- Written tests 1 and 2 (60% of the final grade): The program is structured in two blocks: at the end of each block a written test will be carried out with questions of different types (definitions, resolution of brief assumptions) about the contents of each block. Each test will be scored from 0 to 10. The values ??of each test will always be averaged that the rating of each one is greater than 4. Evaluation criteria: logical order of the contents of the answer, relevance and rigor of the concepts used, accuracy of terminology.

- Practical work / practical exam: (20% of the final grade). It consists of a personal work, or a group reduced, containing the approach and implementation of a "GIS" application to an assumption of medium complexity chosen by the student and that has the approval of the teacher. It is rated from 0 to 10 and to pass the subject is It is necessary to obtain at least 5 points. Evaluation criteria: correction of the general structure; accuracy in definition of the objectives; adaptation and correction of the methodology; relevance of the data model and the applied functions; correct design of maps and graphics; appropriate use of bibliography; formal correction. The deadline will be 1th of June.
-Activities developed in the classes (20% of the final grade): They consist of practical exercises on theory and management of a GIS program. The correctness of the answers to the questions raised will be assessed, the adequacy of the methods used in the resolution of the proposed exercises, the formal quality of the cartographic models. HE rate from 1 to 10 as follows: up to 10: more than 75% of the exercises have been correctly resolved; up to 7: between 50% and 75%; up to 4: between 25% and 50% and 1 less than 25% of the exercises. It will surpass this test if 5 or more points are obtained. The deliveries must be weekly, since their development is parallel to the evolution of the subject.

b) Global evaluation test
a) Tests: Final exam of the theoretical and practical contents of the subject. The exam will consist of a test written about the contents of the subject and will be formed by open questions and exercises. It assumes 80% of the final score. To pass the subject, the qualification of this exercise must be equal to or greater than 5. In addition, each The student will do the corresponding practical work or practical exam as in the modality of the continuous evaluation (each work or exam of practices supposes 20% of the final qualification). The deadline of delivery will be on 1th ofJune.
b) Evaluation criteria. Written examination: logical order of the contents of the response, relevance and rigor of the concepts used, accuracy of the terminology. Practical work / internship exam: structure correction general; precision in the definition of objectives; adaptation and correction of the methodology; relevance of the model of data used and functions applied.

Second Call
Global evaluation test (to be done on the date set in the calendar)
A) Tests: Final exam of the theoretical and practical contents of the subject. The exam will consist of a test written about the contents of the subject and will be formed by open questions and exercises. It assumes 80% of the final score. To pass the subject, the qualification of this exercise must be equal to or greater than 5. In addition, each student will do the corresponding practical work or practical exam as in the modality of the continuous evaluation (each work or exam of practices supposes 20% of the final qualification). The deadline of delivery of the same will be on September 1th.
B) Evaluation criteria. Written examination: logical order of the contents of the response, relevance and rigor of the concepts used, accuracy of the terminology. Practical work / internship exam: structure correction general; precision in the

definition of objectives; adaptation and correction of the methodology; relevance of the model of data used and functions applied.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, practical exercises, individual and group tasks, field work, autonomous work and study, which are arranged in a logical sequence related to the creation, organization, analysis and use of geographic information.

Students are expected to participate actively in the class throughout the semester.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

4.2. Learning tasks

The course includes the following learning tasks:
- Lectures (51 hours)
- Individual and/or group tasks (25 hours)
- Field work (4 hours)
- Guided tasks (20 hours)
- Autonomous work and study (116 hours)
- Assessment tasks (9 hours)

4.3. Syllabus

The course will address the following topics:

Section I. Introduction. Data models. Data organization and management
- Topic 1. Context, components, definition and applications of geographical information systems
- Topic 2. The representation of geographical space in the GIS Data Models
- Topic 3. Obtaining and organizing information. Creation and maintenance of geodatabases

Section II. GIS Functions for spatial analysis and visualization of geodata
- Topic 4. GIS and geographical analysis: basic concepts
- Topic 5. Introduction to the analysis of vector data
- Topic 6. Modeling and basic raster data analysis
- Topic 7. Visualizing geodata in GIS

4.4. Course planning and calendar

The course is divided into 2 main sections. The first one includes the following topics: 0, 1, 2, and 3; it runs during the first 4 months of the semester (September-January). The second section includes the topics 4, 5, 6 and 7; it runs during the following four months (February-May).

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the ?Facultad de Filosofía y Letras? website (https://fyl.unizar.es/horario-de-clases#overlay-context=horario-de-clases)

Provisional course planning

Month	Written examination	Tasks	Month	Written examination	Tasks
Sep			**Feb**		First week of March: Deadline for the creation of groups for the final practical assignment.
Oct			**Mar**		
Nov			**Apr**		Field work at the IGEAR
		Development of theoretical and		Continuous	Development of theoretical and practical activities of the topics 4 to 7.

Dec		practical activities of the topics 1 to 3	May	assessment. Second partial test (topics 4-7)	Preparation and monitoring of final assignment
Jun	Continuous assessment. First partial test (topics 1-3)				

4.5. Bibliography and recommended resources

1. Basics texts

- ***Bernhardsen, T.*** (2002): *Geographic Information Systems. An Introduction,* Jonh Wiley & Sons, Nueva York. (428 páginas)
- Bosque, J. (1992): *Sistemas de información geográfica,* Rialp, col.: *Monografías y tratados GER,* Madrid.
- ***Escolano, S.*** (2015): *Sistemas de información geográfica. Una introducción para estudiantes de Geografía,* Universidad de Zaragoza, colección ?Textos Docentes?, Zaragoza (255 páginas).
- ***Gutiérrez, J., y Gould, M.*** (1994): *Sistemas de información geográfica,* Síntesis, Madrid. (256 páginas).
- ***Longley, P. A; Goodchild, M. F.; Maguire, D.J. y Rhind D. W.*** (2001): *Goegraphic Information Systems and Science,* John Wiley & Sons, Inc, Chichester. (453 páginas) (reedición: 2010).
- ***Olaya, V.*** (2012, v1.0): *Sistemas de información geográfica*, (tomo I. 476 páginas, tomo 2: 435 página; disponibles *on line* en formato pdf: http://www.bubok.es/libros/191920/SistemasdeInformacionGeografica
- Smith, J. M. de, Longley, P. y Goodchild, M (2013). *Geospatial Analysis. A comprehensive Guide to Principles, Techniques and Software Tools*, 4ª edición; disponible on line en format .pdf y de página web: http://www.spatialanalysisonline.com/

2. Complementary texts

- BonhamCarter, G. (1994): *Geographic Information systems for Geoscientists: Modelling with GIS,* Pergamon, Londres.
- Bosque, J. y Moreno, A (Eds), (2004): *Sistemas de información geográfica y localización optima de instalaciones y equipamientos,* Rama, Madrid.
- Bosque, J., Escobar, García, y Salado (1994): *Sistemas de Información geográfica. Prácticas con PC ARC/INFO e IDRISI,* Rama, Madrid.
- Buzai, G. y Baxendale, C. (2010). Análisis socioespacial con sistemas de Información Geográfica. Tomo I: perspectiva científica. Temática de bases ráster, Lugar Editorial, buenos Aires.
- Calvo, M. (1993): *Sistemas de Información Geográfica Digitales. Sistemas Geomáticos,* IVAP, Oñati.
- Cebrián, J.A. (1992): *Información geográfica y sistemas de información geográfica (SIG),* Serv. Public. Univ. de Cantabria, Santander.
- Chrisman, N. (2002): *Exploring Geographic information systems,* Jonh Wiley & Sons, Nueva York.
- Comas, D., y Ruiz, E. (1993): *Fundamentos de los sistemas de información geográfica,* Ariel, *Ariel Geografía,* Barcelona Chrisman, N. (2002): *Exploring Geographic information systems,* Jonh Wiley & Sons, Nueva York.
- DeMers, M. N. (1999): *Fundamentals of Geographic Information Systems,* Jonh Wiley & Sons, Nueva York.
- Felicísimo, A.M. (1994): *Modelos digitales del terreno. Introducción y aplicaciones en las ciencias ambientales,* Pentalfa, Oviedo. Se puede obtener en: http://www.etsimo.uniovi.es/~feli/TextosP.html
- Fuenzalida, M., Gustavo D. Buzai, Antonio MorenoJiménez, y A. García de León (ed.) (2015). *Geografía, geotecnología Y análisis espacial: Tendencias, Métodos Y Aplicaciones*. Santiago (Chile): Tirángulo. Se puede obtener en: http://www.uahurtado.cl/pdf//Fuenzalida_et_al._2015_Geografa_Geotecnologa_y_Anlisis_Espacial.pdf
- Gómez, M. y Barredo, J. I. (2005): *Sistemas de información geográfica y evaluación multicreterio en la ordenación del territorio*, Rama, Madrid (2ª edición).
- Hearnshaw, H., y Unwin, D. (1994): *Visualization in Geographical Information Systems,* Jonh Wiley, Londres.
- Heywood, I., y Cornelius, S. y Carver, S. (2002):*An introduction to geographical information systems,* Prentice Hall, Harlow.
- Kraak, M. y Brown, A. (eds) (2001): *Web Cartography. Developments and prospect,* Taylor & Francis, Londres.
- Lo, C. P. and A. K. W. Yeung (2007): *Concepts and Techniques of Geographic Information Systems*, Saddle River, NJ, Prentice Hall.
- Longley, P., Smitth, M. y Goodchild, M. (20007): *Geospatial Analysis, A Comprehensive Guide to Principles, Techniques and Software Tools*, Matador, Leicester,

- MacEachren, A.M., y Fraser, D.R. (Ed.), (1994): *Visualization in Modern Cartography,* Pergamon.
- Maguire, D., Batty, M. y Goodchild, M. (2005): *GIS, Spatial Analysis and Modeling*, ESRI Press, Redlands, CA.
- Mancebo Quintan, S.; Ortega Pérez, E.; Valentin Criado, A.C.; Martín Ramos, B.; Martín Fernández, L. (2008): *Libro SIG: aprendiendo a manejar los SIG en la gestión ambiental*, Madrid. http://oa.upm.es/1244/
- Martin, D. (1996): *Geographic information systems. Socioeconomic applications*, Roudledge, Londres y Nueva York.
- Mitchell, A. (1999): *The ESRI Guide to GIS Analysis*, ESRI Pres, Redlands, CA.
- Moldes, F.J. (1995): *Tecnologías de los Sistemas de Información Geográfica,* Rama, Madrid.
- Moreno, A. (ed.) (2005): *Sistemas y análisis de la información geográfica. Manual de autoaprendizaje con ArcGis,* Rama, Madrid.
- Moreno, A., Buzai, G. D. Fuenzalida, M. Colsa, A. (2012): *Sistemas de información geográfica. Aplicaciones en diágnosticos territoriales y decisones geoambientales*, Rama, Madrid
- Peña, J. (2006): *Sistemas de información geográfica aplicados a la gestión de territorio. Entrada, manejo, análisis y salida de datos espaciales. Teoría general y práctica para ESRI ArcGIS 9,* Departamento de Ecología, Universidad de Alicante, Alicante.
- Pickles, J. (Ed.), (1995): *Ground Truth. The Social Implications of Geographic Information Systems,* The Guilford Press, Nueva York.
- Santos, J. M. (2008): *Los sistemas de información geográfica vectoriales: el funcionamiento de ArcGis*, Cuadernos de prácticas, UNED, Madrid.
- Spence, R. (2001): *Information Visualization*, ACM Pres, AddisonWesley*,* Pearson Education Limited, Harlow.
- Zeiler, M. (1999): *Modeling Our World. The ESRI Guide to Geodatabase Desing,* ESRI Press, Redland.

3. Diccionaries and Glossaries

- GIS Glossary*:* http://wiki.gis.com/wiki/index.php/GIS_Glossary
- González, R. 1994. *Diccionario de términos SIG. Madrid: Instituto de Economía y Geografía,* (IEG), CSIC.
- GIS Dictionary (ESRI): http://support.esri.com/en/knowledgebase/Gisdictionary/browse
- GISWEB (Universidad de Alcalá de Henares, the University of Melbourne): http://www.geogra.uah.es/gisweb/
- National Center for Geographic Information Analysis (NCGIA): http://www.ncgia.ucsb.edu

4. Scientific Journals

- *GEOFocus***:** http://geofocus.rediris.es/
- *Cartography and Geographic Information Systems*. Journal of the American Congress on Surveying and Mapping
- *GEO Europe. (antes GIS Europe).* The geographic tecnology magazine for the British Isles, mainland Europe, the Middle East and Africa: (http://www.geoplace.com).
- *GEO Informatics.* Magazine for GEOIT Professionals, GEOIT, Holanda: (http://www.geoinformatics.com)
- GeoSpatialSolutions: (http://www.geospatialonline.com)
- *GIS World*. GIS World Inc, Fort Collins, US
- *International Journal of Geographic Information Sciences,* Taylor & Francis, Londres
- *Mapping*. Revista de Cartografía, Sistemas de Información Geográfica, Teledetección y Medio Ambiente. Cartosig Editorial, S.L. Madrid.

5. Conference Proceedings

- *Proceedings of ?Conferencia Iberoamericana de Sistemas de Información Geográfica? (COFIBSIG):* http://www.gesigproeg.com.ar/linkconfibsig.htm
- *Proceedings of Working Group on ?Geographical Information Tecnologies? (Asociación de Geógrafos Españoles? AGE)*: http://age.ieg.csic.es/metodos/

6. Internet Data Servers

- **Confederación hidrográfica del Ebro**. **SITEbro**: Ebro ValleyTerritorial Information System http://iber.chebro.es/sitebro/sitebro.aspx
- **Gobierno de Aragón. Instituto geográfico de Aragón (IGEAR).** Geographical information and documentation (data, maps and geographical data) of Aragón: http://idearagon.aragon.es
- **Instituto Geográfico Nacional. SIGNA:** National Geographical Information system of Sapain: http://signa.ign.es/signa/

7. GIS software
- There are many software that can manage geographical information: some have a few functions for recording information and develop simple thematic maps; at the other it was software that properly can be called GIS, which

have a lot of functionsanalyze, structure and visualize geodata.

- ***ArcGIS*** v.xx : http://www.esri.com/
- ***Otros programas SIG gratuitos***
- ***Crime Stats® III***. (A Spatial Statistical Program for the Analysis of Crime Incident Location): http://www.icpsr.umich.edu/CrimeStat/
- ***Diva GIS***. : http://www.divagis.org/
- ***Grass GIS***. GRASS (Geographic Resources Analysis Support System): http://grass.osgeo.org/
- ***gvSIG***. Sistema de información geográfica desarrollado por la "Asociación para la promoción de la geomática libre y el desarrollo de gvSIG". Es un programa libre, muy extendido por su gran capacidad para el análisis y visualización de información geográfica: http://www.gvsig.org/web/
- ***Quantum GIS***: http://qgis.org/

8. Other online resources

- Internet has become an indispensable tool for disseminating geodata and and geographical knowledge. Any search with the term "geographical information systems" (GIS, SIG), or the word "mapping" (cartography), produces numerous, sometimes excessive, references. Examples are listedbelow but, by the nature of the medium, it is advisable to periodically scan the network
- In addition to the bestknown generalpurpose search engines, the following are of interest to query on geographical information.
- http://www.metacrawler.com
- http://www.geoplace.com
- http://www.gisdatadepot.com