7.14 CE0734 – Geographic Information Systems

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0734**	**SEMESTER**	**9**
COURSE TITLE	**Geographic Information Systems**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	4	3
Lab exercises	1	1
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	**4**	**4**

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general knowledge
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (English)
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV286/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The aim of the course is to present the necessary concepts to students so that they are able to design, develop, manage and implement a complete system of geographic information using modern tools, methods, and techniques in an ever-changing competitive environment.

By its nature, the science of Geographical Information is an interdisciplinary subject, which, however, apart from the high standards of its theoretical existence, also has a large part of the application of its methods. Therefore, the course material and its structure in two distinct but interrelated sections (theoretical and applied), aims at a deeper understanding of both the substance and the methodology, as well as the management of geospatial information with the most modern software tools related to the subject. . At the same time, the knowledge and skills acquired by the students attending the course do not lead to a sterile and strictly theoretical training, but through a known and accessible to the average student in the 6th level of complexity of the subjects raised, they are faced with issues. to be faced in the labor market. In addition, they receive all those cognitive supplies and skills, which in combination with the more specific cognitive subjects of the Science of Geographical Information

contained in their curriculum, acquire the opportunity to claim their place in the next level (8th) of their studies.

According to the design of the content of the specific subject, students cognitively approach the following:
a) The fundamental concepts, functions, and capabilities of Geoinformatics and Geospatial Information Management Systems,
b) The different types and structures of data, their advantages, and disadvantages
c) The relations between the categories of geographical data,
d) The theoretical and technological knowledge, but also the technical skills related to the registration, analysis, management, retrieval, and display of geospatial information
e) The design, creation, and development of integrated Geographic Information Systems,
f) The importance of Geoinformatics projects in projects of national and international scope.

Therefore, the objectives of this subject matter extend to a description of those who have successfully attended this subject, which has the following characteristics:
a) The assimilation of theoretical and applied knowledge on the Science of Geographical Information.
b) The development of intellectual and practical skills in solving problems that arise in the design, creation, and management of integrated Geographic Information Systems.
c) The development of skills through the synthetic creation and support of arguments related to the science of Geographical Information and strengthen the responsibility and autonomy to acquire sufficient opportunity for further professional and personal development.
d) The development of possibilities of a professional approach to the object through the use of the knowledge and understanding acquired during the work of creation and management of integrated Geographic Information Systems but also of a communicative nature through which the results of the work are successfully communicated to both specialized and non-specialized -skilled audience.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?;.

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*

Specifically, students will be able to perform:

- Search, analysis, and synthesis of data and information, using the necessary technologies
- Adaptation to new situations
- Decision making
- Autonomous work
- Teamwork
- Exercise criticism and self-criticism
- Promoting free, creative, and inductive thinking

(3) SYLLABUS

Theoretical Part of the Course

1. Geographical and Spatial Data and Information, Geoinformatics, Science of Geographical Information:
    - Basic principles and terminology
    - Information, data, and spatial reports.
    - Geospatial information, data sources, technologies, and techniques for their collection.
    - Organization of Geospatial Information, models, and structures.
    - Introduction to Geographic Information Systems, characteristics, definitions, evolution over time, categories and species, components, function, use.
2. Conceptual Codification:
    - Spatial - non-spatial properties, characteristics of spatial entities.
    - Structure, relationships, and combinations of spatial entities, spatial changes, mechanisms of spatial

data organization.

3. The Geometry of Spatial Information:
   - Geographical location, representation, dimensions, placement of geographical objects in spatial reference systems.
   - Vector models, point and distance view, line and surface view, topological relations.
   - Raster models and their topological relations.
   - Data entry subsystems, management of geometric information in GSP, transformations.
4. Geospatial Databases - Models and Structures:
   - Architecture and structure of a database management systems.
   - Design and development of spatial databases. Input of descriptive information, connection to external databases, methods of correlation of the data.
5. Codification - Integration of Spatial Information: Connection and correlations of Geometric - Descriptive Information.
   - Recognition - correction of errors. Topological integration. Retrieval, information update, spatial queries.
   - Geographic Information on the Internet (Web-GIS, Internet Mapping).
   - Specifications, Protocols, Structure, Diffusion, and Interoperability.
   - National and international geographic data networks.
6. Principles of Analysis and Design of a GIS:
   - Terminology
   - General design
   - Identification of input elements.
   - Analysis of financial characteristics
   - Customization of the organization by a group of users
   - Detailed system design
   - Meta-information dictionaries
   - Problems
7. Introductory elements of Spatial Analysis.

Applied Part of the Course

- Organization, classification, codification, and normalization of geospatial information
- Design and development of geospatial databases
- Introduction of geometric, pictorial, and descriptive data in a geographic information system
- Automation of geospatial information - Geometric topological relations and topological integration.
- Retrieval, management, and updating of geospatial information
- Visual representation (mapping) of geospatial information
- Interoperability

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Web search (literature review and data sources) • Utilization of E-class UNIWA platform (file exchange among professors and students) • Use of email • Use of specialized software (both commercial and open source) for the manipulation, editing and mapping of the geospatial data • Use of Office software (word, presentations, spreadsheets)
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.*	

Activity	***Semester workload***
Lectures	39
Study and analysis of bibliography	25
Laboratory practice	13
Elaboration of individual study	35

The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS	Educational visits	8
	Course total	**120**

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open- ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Language of Evaluation: Greek Evaluation Methods • Written exam at the end of the semester (Multiple choice, short development and problem-solving exercises) • Homework evaluation (development of theoretical topic and commentary of scientific articles • Evaluation of laboratory work (development of the topic of creating and managing an integrated GIS) Oral presentation of work (Ms Office presentation of the theoretical topic)

(5) ATTACHED BIBLIOGRAPHY

Greek Bibliography:

1. P. Longley, M. Goodchild, D. Maguire, D. Rhind, 2010. "Geographic Information System and Science", 6th edition. Publication in Greek language, by Klidarithmos Editions, Athens.
2. J. Katsios, A. Tsatsaris, 2014. "Lectures of Thematic Cartography", Publication in Greek language, by Disigma Editions, Thessaloniki.
3. A. Zisou, 2007. "Introduction to Geographic Information Systems. ArcGis-ArcView. Publication in Greek language, by Stamoulis Editions.
4. E. Stefanakis, 2010. "Geographical Databases and GIS". 2nd edition. Publication in Greek language, by Papasotiriou Editions.

Foreign Bibliography:

1. Bolstad, P., 2016. GIS Fundamentals: A First Text on Geographic Information Systems, Fifth Edition, Eider Press.
2. Kerski, J. & Clark, J., 2014. The GIS Guide to Public Domain Data. ESRI Press
3. Rigaux, P, Scholl, M, 2002, Spatial databases :with application to GIS, San Francisco, CA: Morgan Kaufmann Publishers
4. McDonnell, R, Kemp, K, International GIS dictionary Cambridge, [England] : GeoInformation International ; New York, NY : John Wiley & Sons , 1995
5. Kraak, M. J., Ormeling, F. J., 1996, Cartography: Visualization of spatial data, Harlow, Longman

Related academic journals:

1. International Journal of Geographical Information Science, Taylor & Francis
2. Geoinformatica, Springer
3. Journal of Geographical Systems, Springer
4. Journal of Geographic Information System Scientific Research
5. ISPRS-International Journal of Geo-Information (IJGI is an open access journal of MDPI)

Web pages:

1. http://www.hellasgi.gr/ (Greek Organization for Geographic Information)
2. http://eurogi.org/ (European Umbrella Organization for Geographic Information)
3. http://www.opengeospatial.org/ (Open Geospatial Consortium)
4. http://support.esri.com/other-resources/gis-dictionary/a (GIS Dictionary)
5. http://www.ncgia.ucsb.edu/Publications/Tech_Reports/92/92-13.PDF (GIS Terminology)
6. http://hydroscope.gr/ (National Bank of Hydrological and Meteorological Information) http://www.geodata.gov.gr/ (Public Open-source national geoportal)
7. https://www.gislounge.com/open-source-gis-applications/ (Open Source GIS Software)

8. https://www.gislounge.com/gis-software-applications/ (Commercial and Proprietary GIS Software)
9. https://www.gislounge.com/bibliographies/ (Bibliographies)