

COURSE OUTLINE

(1) GENERAL

SCHOOL	UNIVERSITY OF THESSALY		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	TK0910	SEMESTER	9
COURSE TITLE	Spatial Analysis Techniques and Remote Sensing Applications in Civil Engineering		
INDEPENDENT TEACHING ACTIVITIES <i>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</i>		WEEKLY TEACHING HOURS	CREDITS
The course focuses on applied spatial analysis using GIS and remote sensing for civil engineering applications. It includes methods and techniques for modelling spatial processes for decision making. Hence, this course strengthens students' technical and intellectual competency in spatial analysis with GIS and remote sensing in civil engineering applications. The course imparts the basic theoretical and practical understanding represented by the knowledge and skills outcomes via a mix of self-learning and formal teaching, including formal lectures and practicals in the lab sessions with active student participation. Lectures introduce theory and concepts, which are then exemplified in computer labs and exercises using specialist packages and tailored data sets. A substantial piece of coursework will test the students' ability to understand and apply the knowledge they acquire in practice at the lab sessions, including the use of methods and software. In addition, as it is an open ended work it also tests students' initiative.		4	6
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialized general knowledge, skills development</i>	Special Background		
PREREQUISITE COURSES:	Physics I, Physics II, Probabilities and Statistics, Geographic Information Systems , Technical Drawing and CAD		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)			

(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

Knowledge of the current spatial analysis techniques needed for a new engineer. A special focus is given to Remote Sensing techniques as well as the related software capabilities.

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

Adapting to new situations

Decision-making

Working independently

Team work

Working in an international environment

thinking Working in an interdisciplinary environment

Production of new research ideas

Project planning and management

Respect for difference and multiculturalism

Respect for the natural environment

Showing social, professional and ethical responsibility and sensitivity to gender issues

Criticism and self-criticism

Production of free, creative and inductive

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Others...

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(3) SYLLABUS

Basic concepts of Physics and Mathematics. Methodologies and applications of Remote Sensing and Photogrammetry.

Electromagnetic radiation. Electromagnetic spectrum. Active and Passive Sensors.

Remote sensing platforms and global applications. Aerial and satellite systems. Map scale and projections. Pros and cons. Lab Applications.

Remote Sensing Image Analysis and Applications. Multi-raster images, radar images. Introduction to radiation, reflection and emission concepts. Preprocessing of satellite images. Radiometric, geometric and atmospheric corrections.

Image filtering. Spectral signatures. Histograms. Linear stretching. Filters. Data editing and standards. Transformation of multispectral images.

Subset and clipping. Image fusion/merge. Image algebra. Vegetation indices and soil interpretation.
Supervised classification. Maximum likelihood rule. Bayes theory. Classification using minimum distance and Mahalanobis distance. Classification accuracy and errors calculation. Non-supervised classifications. Pros and cons.
Change detection theory. Remote sensing and thematic maps analysis. Regions of interest. Applications in earth mapping, ecosystems and land use.. LANDSAT TM, ETM+, SPOT, Quickbird, IKONOS imagery and applications in Greece and worldwide.
Spatial analysis & processing. Accuracy assessment. Applications.
Applications in civil engineering (works construction, urbanization, deforestation, land cover and land use, irrigation, land reclamation projects, water resources, climate change, road construction, geodesy, geotechnical engineering coastal engineering, natural disasters).
Introduction to Remote Sensing commercial software packages (ERDAS IMAGINE or/and ENVI). Image processing and classification techniques. Lab Exercises.
Classification of spatial data. Spatial correlation and autocorrelation.
Spatial Modelling with GIS.
Spatial interpolation advanced techniques (points, lines, polygons).

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY <i>Face-to-face, Distance learning, etc.</i>	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	Laboratory education and theory. Lab exercises.	
TEACHING METHODS <i>The manner and methods of teaching are described in detail.</i> <i>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.</i> <i>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</i>	<i>Activity</i>	<i>Semester workload</i>
	Courses	56 hours
	Project	64 hours
	Assignment	30 hours
	Course total	150 hours

STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure</i> <i>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</i> <i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	Essay/report 50% Written exams 50%
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(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

In Greek:

- Καρτάλης Κ. και Φείδας Χ., 2006. Αρχές και Εφαρμογές Δορυφορικής Τηλεπισκόπησης, εκδόσεις Γκιούρδας, Αθήνα.
- Μερτίκας Σ., 2006. Τηλεπισκόπηση και Ψηφιακή Ανάλυση Εικόνας, Εκδόσεις Ίων, Αθήνα.
- Μηλιαρέσης, Γ. Χ., 2003. Φωτοερμηνεία – Τηλεπισκόπηση, Εκδόσεις Ίων, Αθήνα.
- Περάκης, Κ., Μωυσιάδης, Α., Φαρασλής, Ι. 2015. Η τηλεπισκόπηση σε 13 ενότητες. [ηλεκτρ. βιβλ.] Αθήνα: Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών. Διαθέσιμο στο: <http://hdl.handle.net/11419/1853>.
- Ηλιοπούλου, Π., 2015. Γεωγραφική ανάλυση. [ηλεκτρ. βιβλ.] Αθήνα: Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών (<http://hdl.handle.net/11419/2059>).
- Καλογήρου, Σ., 2015. Χωρική ανάλυση. [ηλεκτρ. βιβλ.] Αθήνα: Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών (<http://hdl.handle.net/11419/5029>).

In English:

- Burrough, P.A., and R.A. McDonnell, 1998. «Principles of Geographical Information Systems», Oxford University Press, Oxford, ISBN: 978-0198233657.
- Chang, K.-T., 2010. «Introduction to Geographic Information Systems», 5th Ed., McGraw-Hill, ISBN: 978-0071267588.
- Heywood, I., S. Cornelius, and S. Carver, 2012. «An Introduction to Geographical Information Systems», 4th Ed., Prentice Hall, Pearson, ISBN: 978-0273722595.
- Longley, P.A., M.F. Goodchild, D.J. Maguire, D.W. Rhind, 2015. «Geographic Information Systems and Science», 4th Ed., Wiley, ISBN: 978-1118676950.
- Longley, 2018. «Geospatial Analysis: a Comprehensive Guide to Principles, Techniques and Software Tools», 6th Ed., ISBN: 978-1-912556-05-2.