General course information:

Course title:	**Geographic Information Systems**	**Course code:**	ΓΚ1402
Credits:	3	**Work load (hours):**	90
Course level:	Undergraduate ☑	Graduate ☐	
Course type:	Mandatory ☑	Selective ☐	
Course category:	Basic ☑	Orientation ☐	
Semester:	5th	**Hours per week:**	4

Course objectives (capabilities pursued and learning results):

Geographic Information Systems (GIS) are systems designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data. Scope of the course is the introduction of Geographic Information Science which studies geographic information systems. 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. Furthermore, the course is focused on applied spatial analysis using GIS 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 in civil engineering applications. Upon completion of the course, students should be able to demonstrate:

- Understanding of the basic concepts and techniques related to geographical information science and systems
- Ability to create, manipulate and analyse geographical and spatial data by combining multiple sources in vector and raster formats
- Skills for processing spatial (raster and vector) data with specialized software
- Ability to create flow diagrams and models for spatial analysis using geoprocessing operations
- Ability to identify and model spatial patterns from point, line and polygon entities and continuous surfaces
- Ability to perform Multi-Criteria Decision Analysis within GIS for spatial development projects

Prerequisites:

Technical Drawing & CAD
Geodesy
Computer Programming

Instructor's data:

Name:	Dr. Lampros Vasiliades
Level:	Laboratory Teaching Staff (EDIP)
Office:	
Tel. – email:	+30-2421074115 – lvassil@civ.uth.gr
Other tutors:	

Specific course information:

Week No.	**Course Contents**	**Hours**	
		Course attendance	**Preparation**
1	• Geographical Information Systems (GIS): An Introduction. General Principles of GIS. • GIS Lab – Introduction in the GIS software. Viewing and creating datafiles	**4**	**1**
2	• Geographic and Projected Coordinate Systems. • GIS Lab – Coordinate Systems. Exercise 1.	**4**	**1**
3	• GIS and Spatial Analysis. Methodology of Spatial Analysis. • GIS Lab – Map and Image Georeferencing. Exercise 2.	**4**	**1**
4	• Entities: Vector and Raster Models. • GIS Lab – Digitization. Editing vector files and attribute tables. Exercise 3.	**4**	**1**
5	• Data Analysis of Vector and Raster Models. Topological modeling. • GIS Lab – Image Processing. Automatic vectorization. Exercise 4.	**4**	**1**
6	• Database Management. Database Management Systems (DBMS). Spatial DBMS. • GIS Lab – Geodatabases. Relational Database Management Systems (RDBMS). Exercise 5.	**4**	**1**
7	• Data output and Cartography. • GIS Lab – Layouts. Exercise 6.	**4**	**1**
8	• GIS Analysis - Geoprocessing. Preprocesses. Analysis of Vector Data (e.g. Boolean Algebra, Logical Operations). Analysis of Raster Data (Local, Focal, Zonal and Global Functions). • GIS Lab – Geo-processes. Flow Diagram and Model Builder. Exercise 7.	**4**	**1**
9	• Methods of Spatial Analysis – Point Entities: Spatial Patterns. • GIS Lab – Geo-processes. Flow Diagram and Model Builder. Exercise 8.	**4**	**1**

10	• Methods of Spatial Analysis – Continuous Surfaces: Spatial Patterns and Spatial Interpolation. • GIS Lab – Spatial Interpolation Methods and Models. Exercise 9.	**4**	**1**
11	• Methods of Spatial Analysis – Continuous Surfaces: Spatial Patterns and Spatial Interpolation. • GIS Lab – Triangulated Irregular Networks (TINs) and Geomorphology. Exercise 10.	**4**	**1**
12	• Methods of Spatial Analysis – Non-continuous Surfaces: Spatial Patterns of Polygons. • GIS Lab – Site Mapping of Technical Projects. Exercise 10.	**4**	**1**
13	• Spatial Sampling. Sampling Techniques. • GIS Lab – Multi-Criteria Decision Analysis with GIS.	**4**	**1**
14	• Integrated Spatial Analysis with GIS. Examples and Case Studies.	**4**	**1**

Additional hours for:			
Class project	**Examinations**	**Preparation for examinations**	**Educational visit**
18	2		

Suggested literature:

Koutsopoulos, K.X., 2017. «Geographic Information Systems and Spatial Analysis», Disigma Publications, ISBN: 978-618-5242-11-4. [in Greek]

Koutsopoulos, K.X., N. Androulakakis, 2011. «Geographic Information Systems with ArcGIS 10», A. Papasotiriou & Sia OE, ISBN: 978-9604910304. [in Greek]

Tsouchlaraki, A., G. Achileos, N. Kourgialas, 2019. «Learning GIS: ArcGIS 10.5», 3rd Edition Έκδοση, Disigma Publications, ISBN: 978-618-5242-57-2. [in Greek]

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.

De Smith, M.J., M.F. Goodchild, P.A. Longley, 2018. «Geospatial Analysis: a Comprehensive Guide to Principles, Techniques and Software Tools», 6th Ed., ISBN: 978-1-912556-05-2.

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.

Teaching method *(select and describe if necessary* - **weight***):* To impart 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. For Geographic Information Systems, the theory underpinning modern practice is taught in lectures and then is tested in practical lab sessions.		
Teaching	☑	40%
Seminars	☐	…….%
Demonstrations	☐	…….%
Laboratory	☑	40%
Exercises	☑	20%
Visits at facilities	☐	…….%
Other *(describe):* …….	☐	…….%
Total		100%

Evaluation method *(select)*- **weight:** 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. Assessment will be 100% coursework. A headstart will be made using computational resources during the lab sessions, with further analysis and writing up afterwards.				
	written	*%*	*Oral*	*%*
Homework	☑	20	☐	
Class project	☑	60	☑	20
Interim examination	☐		☐	
Final examinations	☐		☐	
Other *(describe):* ……	☐		☐	