Theory and Applications of Geographic Information Systems and Science (GIS)

Instructor: Dr. Aviva Peeters

3 weekly hours, 3 credits, Undergraduate

Description:

The course is an introduction to the concepts and application of geographic information systems and science (GIS). It is designed for students without former GIS experience, but students who have taken a course before can benefit from taking it. It focuses on the use of GIS for scientific inquiry and on its application for real-world problem solving. Different types of GIS spatial analysis are studied and applied such as suitability analysis, surface analysis and 3D analysis. Case studies from various environmental research domains are used as demonstrations. Each lesson comprises of a theoretical introduction and of an exercise. The exercises include training on the ArcGIS® Desktop software package.

Grading is based on home exercises and on a semester project. The project consists of designing and applying a GIS analysis model relevant to the student's field of interest.

Students are required to give an oral presentation and a final research paper based on their project. Both will be submitted at the end of the semester.

Grading:

Participation and Attendance -15%

Project's oral presentation – 20%

Project's research paper – 50%

Home exercises – 15%

Comment:

Attending the classes is compulsory and accounts for 15% of the grade - regular attendance is necessary to succeed in this course. It is impossible to acquire a working knowledge of GIS without understanding the theory and principles behind the GIS software, along with gaining hands-on experience.

Recommended Reading:

1. Smith, M.J., Goodchild, M.F. Longley, P.A. (2021). Geospatial analysis ebook: http://www.spatialanalysisonline.com/

2. Chrisman, N. R. (2002). Exploring Geographic Information Systems. Wiley, New York.

3. Longley, P. A., Goodchild, M. F., Maguire, D. J., Rhind, D. W. (2011). Geographic Information Systems and Science. Wiley, New York.

4. Bolstad, P. (2019). GIS Fundamentals: A First Text on Geographic Information Systems, Sixth Edition, Eider Press, MN.

5. DeMers, M. N. (2009). Fundamentals of Geographic Information Systems. Wiley, New York.

6. Longley, P.A., Batty, M. (2007). Spatial Analysis: Modelling in a GIS Environment. Wiley, New York.

7. Maguire, D., Batt, M., Goodchild, M. (2005). GIS, Spatial Analysis and Modelling, ESRI Prees, Redlands, CA.

8. Course Exercise Manual and articles supplied by instructor.

Electronic Resources:

Google Classroom for sharing articles, lectures and tutorials.

Software, online support and data: http://www.esri.com/

ArcGIS Online: http://www.arcgis.com/home/

Spatial analysis ebook: http://www.spatialanalysisonline.com/

GIS www resource list: http://gislounge.com/   http://www.giscafe.com/

GIS glossary: http://support.esri.com/en/knowledgebase/Gisdictionary/browse

http://wiki.gis.com/wiki/index.php/Main_Page

Lessons:

Lesson 1

An introduction to GIS: history, theory, concepts, components and applications.

Lesson 2

An introduction to the ArcGIS Desktop software package.

Lesson 3

Building the GIS database part I

- Database design and structure.
- Data sources and data types.
- Collecting, processing and editing data.
- Working with metadata.

Lesson 4

Building the GIS database part II

- Coordinate systems.
- Georeferencing and digitizing data.

Lesson 5

Spatial analysis part I: concepts, techniques and types.

- The Spatial Analyst extension.
- Vector-based analysis
- Querying, buffering and polygon overlay applied to a suitability analysis.
- The Model Builder.

Lesson 6

Spatial analysis part II:

- GIS data models.
- Geoprocessing

Lesson 7

Display, visualization and presentation (maps, graphs and reports).

Lesson 8

Working with tables in ArcGIS and geolocating

Lesson 9

Working with raster data models (raster overlay applied to a suitability analysis).

Lesson 10

Working with 3D data:

- The 3D Analyst extension.
- Spatial interpolation applied to surface analysis and 3D analysis.
- 3D Visualization

Lesson 11

A summary + Web GIS + Personal guidance (working on personal projects)

Lesson 12

Personal guidance (working on personal projects)

Oral presentations -
paper submission