



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

Instructor: Dr. Aviva Peeters

3 weekly hours, 3 credits

## 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:

Attendance -10%

Project's oral presentation – 20%

Project's research paper – 50%

Home exercises – 20%

## Comment:

Attending the classes is compulsory and accounts for 10% 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. Chrisman, N. R. (2002). *Exploring Geographic Information Systems*. Wiley, New York.
2. DeMers, M. N. (2005). *Fundamentals of Geographic Information Systems*. Wiley, New York.
3. Longley, P. A., Goodchild, M. F., Maguire, D. J., Rhind, D. W. (2005). *Geographic Information Systems and Science*. Wiley, New York.
4. Maguire, D., Batt, M., Goodchild, M. (2005). *GIS, Spatial Analysis and Modelling*, ESRI Press, Redlands, CA.
5. *Course Exercise Manual*, Supplied by instructor.

## **Electronic Resources:**

Google Docs and Google Drive 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.gisafe.com/>

GIS glossary:

<http://support.esri.com/en/knowledgebase/Gisdictionary/browse>

## **Lessons:**

### **Lesson 1**

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

An introduction to the ArcGIS Desktop software package.

***Oct 3<sup>rd</sup> NO Class (Rosh HaShana)***

### **Lesson 2**

An introduction to the ArcGIS software.

### **Lesson 3**

Building the GIS database part I

- Database design and structure.
- Data sources and data types.
- Acquiring data.
- Editing metadata.

### **Lesson 4:**

Building the GIS database part II

- Coordinate systems.
- Georeferencing.
- Digitizing and editing data.

**Lesson 5:**

Spatial analysis part I: concepts, techniques and types.

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

**Lesson 6:**

Spatial analysis part II: GIS data models.

**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 + Personal guidance (working on personal projects)

**Lesson 12+13:**

Oral Presentations