

Theory and Applications of Geographic Information Systems and Science (GIS) (3 credits) 001.2.6002

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Description:

The course is an introduction to the concepts and application of geographic information systems and science (GIS), by focusing on the use of GIS for scientific inquiry, on its application for real-world problem solving and on gaining hands-on experience. Exercises are based on personal training with advanced GIS software and technology for quantitative spatial analysis, modeling and visualization. The course is designed for students without former GIS experience. Case studies from various environmental research domains are used as demonstrations and for gaining practical experience. Each lesson comprises of a theoretical introduction and of a class exercise. The exercises are based on tutorials and include training on the ArcGIS Software environment.

Learning Outcomes:

1. Apply the theory and methods of GIS as a tool for spatial analysis and for scientific inquiry.
2. Develop a personal GIS analysis model and work independently with advanced GIS software and apply it to solve spatial and environmental challenges.
3. Apply GIS analysis for realizing environmental sustainability goals.

Evaluation:

Grading is based on home exercises and on an individual semester project. The final project consists of developing and applying a GIS analysis model for studying a specific research problem, relevant to the student's field of research. The project includes two major presentations: an oral Power Point presentation of the project and a paper based on the project. Both will be submitted at the end of the semester.

Grading consists of:

10% attendance

20% home exercises

20% oral presentation

50% final paper

Course Subjects:

- Introduction to GIS: history and concepts
- The GIS software: components and functions
- Principles of relational database management systems (RDBMS) and spatial databases
- Data sources and types (including remote and proximal sensing), acquiring and collecting data, preprocessing, data classification, metadata and database management
- Map projections and coordinate systems
- Geoprocessing
- Georeferencing
- Data models: raster, vector and TIN
- Spatial analysis: concepts and methods
- Spatial interpolation: concepts and methods
- Overlay-based analysis (raster and vector)
- GIS query: proximity-based analysis, location-based query and attribute-based query
- Digitizing and map editing
- GIS topology
- Display and geovisualization
- WebGIS

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. 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., Batty, M., Goodchild, M. (2005). *GIS, Spatial Analysis and Modelling*, ESRI Press, Redlands, CA.
8. Course Exercise Manual and articles supplied by instructor.

Electronic Resources:

GIS course MOODLE website: <http://moodle2.bgu.ac.il/>

Software, online support and data: <http://www.esri.com/> ArcGIS Pro: <https://www.esri.com/en-us/arcgis/products/arcgis-pro/overview>

ArcGIS Online: <http://www.arcgis.com/features/>

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

e-book: <http://www.spatialanalysisonline.com/>

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