

Geographic Information Systems

Jelgava

Programme

Code of the study course at LLU IS Register:

2.0 CP (32 h): lectures 16 h, practical works 8h, laboratory works 8h, Examination.

The author: Ainis Lagzdīņš, Associated professor of the Department of Environment and Water Management.

Compulsory course of the professional Bachelor's degree level study programmes "Environment and Water Management" and "Landscape Architecture and Planning". The language of instruction is English.

Abstract

This study course is intended to provide an introduction to fundamental concepts and practical application of geographic information systems (GIS). Students learn about the methods and tools commonly used in the geospatial data analysis. Students acquire the ability to create, illustrate and analyze geographic information in a broad range of disciplines related to the environmental science and landscape architecture including hydrology, ecology, forestry, agriculture, cartography.

The aim of the study course:

The aim of the course is to explain the nature of geographic information systems and their application in solving problem situations in different sectors. Students learn to create, edit, manage and use geographic information. Students get acquainted with GIS analytical methods and tools, apply them in environmental engineering, hydropower engineering and landscape architecture.

Learning Outcomes (knowledge, skills and competence)

Upon the completion of this course students will:

1. demonstrate **the knowledge** and understanding of fundamental concepts and practical applications of geographical information systems;
2. develop **skills** to define specific needs in the topic studied, critically evaluate the potential use of GIS and apply relevant GIS methods and tools for spatial problem-solving;
3. demonstrate the **competence** to create and apply geospatial data and geodatabases in other study courses and research activities.

Relation of the study course with other subjects:

Prior knowledge is not required.

Requirements for individual work:

Completed practical works and the course project in the amount of 2CP.

Assessment of knowledge:

Regular check-up of practical skills during the process of practical works and the course project.

Requirements for the admission to the examination/test:

Successfully passed practical works and the presented course project.

Procedure and requirements for settling missed lectures:

According to the procedure approved by the department.

Extended content of the programme

Definition of geographic information systems (GIS). Geographic information systems - new technology in the fields of environmental science and computer science. GIS components and requirements for their application. History of the development of geographic information systems

Components of geographic information systems and their requirements, including hardware and peripheral devices, software, data creation and storage, interactive Internet cards, staff.

Complex character of GIS applications and relation to other fields of science. The application of GIS technologies in various spheres and the features of GIS software. The essence and possibilities of the GIS in solving the problem situations of different sectors.

GIS data models. Vector data, raster data, TIN (triangular irregular network) data. Comparison of data models, peculiarities of their application, advantages and disadvantages.

Data bases and GIS. Creation and use of data basis.

GIS data acquisition. Acquisition, processing and preparation of data from geographic information systems. The peculiarities of vector and raster data acquisition and processing (scanning, digitization, data transformation, satellite image adjustment and attraction, coordinate transformation, etc.).

Remote sensing of the Earth's surface. The history of remote sensing of the GIS and the Earth's surface. Principles and applications using ArcGIS software.

Satellite imagery and their use. Satellite imagery and their use. GIS and satellite imagery development history. Principles and applications using ArcGIS software.

Digital cartography and GIS. History of the development of GIS and digital cartography. Principles and applications using ArcGIS software.

Geospatial information in Latvia and abroad. Free-access geospatial information sources in Latvia and abroad.

Methods and tools of GIS analysis. Geospatial data analysis methods and tools, including Spatial Analyst, 3D Analyst, ArcToolbox, usage possibilities and solutions.

The water management cadastre and GIS. The illustration and analysis of GIS data in water management and hydrology. The digital cadastre of drainage system.

Environmental Risk Modelling and GIS technologies. Analysis of geographic information system data, examples of selection and applications of methods and tools.

Application of GIS technologies in the organization of water quality monitoring. Analysis of geographic information system data, examples of selection and applications of methods and tools.

GIS in agriculture. Analysis of geographic information system data, examples of selection and applications of methods and tools.

GIS in ecology. Analysis of geographic information system data, examples of selection and applications of methods and tools.

GIS in landscape architecture. Analysis of geographic information system data, examples of selection and applications of methods and tools.

List of practical works (16 hours)

1. Getting to know the ArcGIS software for the course project.
2. GIS data models and their structure.
3. Representation of vector and raster data.
4. Independent work with PC.
5. Geodetic data bases and their significance.
6. Selection of spatial geographic objects according to the question asked.
7. Individual work with PC.
8. Creation, editing and maintenance of GIS data.
9. Creation and use of graphic objects.
10. Analysis of GIS data.
11. Individual work with PC.
12. GIS data analysis.
13. Individual work with PC.
14. Digital mapping.
15. Design and printout of a digital map.
16. Presentation and defence of the course project.

Bibliography

Compulsory reading:

1. Bernhandsen T. Geographic information systems. Arendal, Norway: Norwegian Mapping Authority, 1992. 218 p.
2. Stūrmanis E. Ģeoinformācijas sistēmas. Jelgava: LLU / RTU, 2006. 90 lpp.
3. Mūsdienu Latvijas topogrāfiskās kartes. Autoru kolektīvs A. Zelmanis ... u.c. Valsts zemes dienests. Rīga: Valsts zemes dienests, 2001. 203 lpp.
4. The Earth Observation Handbook. [tiešsaiste]. [Skatīts 09.02.2018.]. Pieejams: <http://www.eohandbook.com>

Further reading:

1. Latvijas ģeotelpiskās informācijas aģentūras mājas lapa [tiešsaiste]. [Skatīts 09.02.2015.]. Pieejams: <http://www.lgia.gov.lv/lv/Publikācijas.aspx>
2. Vanags V. Fotogrammetrija. Mūsdienu Latvijas topogrāfiskās kartes. Rīga: Valsts zemes dienests, 2003. 275 lpp.
3. Lauku reģistra ģeogrāfiskā informācija [tiešsaiste]. [Skatīts 09.02.2018.]. Pieejams: <http://www.karte.lad.gov.lv>

Periodicals and other sources of information:

1. ESRI mājas lapa [tiešsaiste]. [Skatīts 09.02.2018.]. Pieejams: <http://www.esri.com>
2. SIA Envirotech mājas lapa [tiešsaiste]. [Skatīts 09.02.2018.]. Pieejams: <http://www.envirotech.lv>
3. Rīgas ģeogrāfiskās informācijas sistēmas mājas lapa [tiešsaiste]. [Skatīts 09.02.2018.]. Pieejams: <http://www.rigis.lv/RIGIS/main.asp>