COURSE DESCRIPTION

Course code	Volume in ECTS credits	Institution	Faculty	Department
MIŠ8011	7	VMU	Forest sciences and ecology	Institute of forest management and wood science

Course title in Lithuanian

Geografinės informacinės sistemos aplinkos tyrimuose

Course title in English

Geographic Information Systems in Environmental Research

Study methods	Volume in ECTS credits
Lectures	2
Consultations	1
Practicums	1
Individual work	3

Short course annotation in Lithuanian (up to 500 characters)

Šiame kurse formuojamas požiūris į geografines informacines sistemas kaip mokslą, todėl didžiausias dėmesys skiriamas tokiems klausimams, kaip geografinių duomenų analizė, mokslu grindžiamas kartografavimas, erdvinė statistika ir geostatistika. Pateikiamas nuotolinių tyrimų įvadas. Akcentuotamas GIS naudojimas moksliniuose tyrimuose bei praktiniuose projektuose.

Short course annotation in English (up to 500 characters)

Geographic information systems are considered in this cource as geoinformation science, thus underlining methodological aspects of GIS, such as geographic data analyses, science-driven mapping, spatial statistics and geostatistics. Remote sensing techniques for capturing geographic data are introduced. Special focus is on using GIS in research and applied projects.

Relevance of the course

After having passed this course the PhD students will acquire systematic knowledge on conducting research in geomatics. The students will develop abilities of using geographic information science in their specific fields of research, particularly related to environmental sciences, in order to generate new fundamental knowledge and ideas, as well as solve relevant practical tasks.

Course aims

To develop a system of scientific knowledge and practical abilities in the area of geographic information science, namely relevant to fundamental tasks in such fields as geographic information systems, digital mapping, geostatistics and remote sensing, aiming for abilities to use geographic information systems for environmental research.

Content (topics) and methods

Lectures:

Lecture 1. Geographic information systems (GIS) and science: GIS as geoinformation science, geoinformation technology and geoinformation studies. History of GIS worldwide and in the country.

Lecture 2. Geographic data: structuring geographic objects of the real world to represent them using digital models, accuracy of geographic data, management of GIS data quality, modern methods and tools for collecting geographic data.

Lecture 3. Geo-reference and thematic GIS databases in Lithuania and abroad: the role of geo-referenced and thematic GIS databases, some available databases, adopting of geo-reference data for specific thematic tasks, development and use of GIS metadata.

Lecture 4. GIS software and hardware: types of GIS software architecture, some currently used GIS packages, specifications of GIS hardware, distributed GIS, the choice of GIS software and hardware to conduct the research, main potential directions of GIS evolution.

Lecture 5. Spatial analysis and its role in environmental research: key functionality of GIS analysis and modelling (queries and selection procedures, data summarizing, overlays, buffering, clipping, etc. using

vector and raster tools), similarities and differences of spatial analysis and conventional statistical treatment of research data, planning GIS analysis, examples of GIS analysis used in environmental research.
Lecture 6. Spatial statistics and their role in environmental research: spatial autocorrelation and location quotient, modifiable areal unit problem, analysing spatial patterns, edge effects, density estimations, hot-spot mapping, local indicators of spatial association, examples of using spatial statistics for environmental research.
Lecture 7. Geostatistics and its role in environmental research: assessment of geographic phenomena geo-statistically and spatial interpolation, the 1st law of geography and it practical importance, main spatial interpolation algorithms: inverse distance weighting, polynomials, splines, kriging, interpretation and assessment of interpolation results, examples of using geostatistics for environmental research.
Lecture 8. Spatial modelling and its role in environmental research: spatial questions and why the physical modelling of some phenomena and processes is problematic, spatial modelling tools, suitability assessment of spatial models, limitations of spatial modelling, examples of using spatial modelling for environmental research.
Lecture 9. Special techniques of spatial analysis and modelling: working with terrain data, address geo-coding, network analysis, linear referencing and dynamic segmentation, decision support using spatial modelling.
Lecture 10. Main principles of GIS data representation (digital mapping): digital mapping and GIS, scientific representation of spatial analysis outputs, how to prepare professionally-looking map using GIS.
Lecture 11. Digital remote sensing information, its role in environmental research and integration with GIS: methods of digital remote sensing, available and planned remote sensing systems, available sources of remote sensing data and its integration in research, acquisition/acquiring remote sensing information.
Lecture 12. GIS on the internet and for the internet: web-GIS and distributed GIS, sources of GIS data on the web, specialised GIS tools for internet.
Lecture 13. Planning the use of GIS: development of project for GIS application, managing GIS project, potential of GIS in scientific research of PhD students.
Lecture 14. Examples of using GIS in specific research and applied projects: application of GIS in forestry, agriculture and environmental sciences, GIS for specific field of application, depending on research interests of PhD student, additional information sources on specific GIS applications.

Practicums:
Planning GIS data collection.
Adopting of GIS database to fit specific research requirements, depending on the research tasks of PhD students.
Development of GIS database.
Conducting spatial analysis and modelling (depending on research interests of PhD student).
Sources of remote sensing information and integration of remote sensing in specific research, conducted by PhD student.

Individual assignment:
Individual assignment depending on specific PhD student's research interests.

Structure of cumulative score and value of its constituent parts

Practicums – 20%, individual assignment - 20%; final exam - 60 %

Compulsory reference materials

No.	Authors of publication, title, publishing house, year of publication.
1.	P.A. Longley, M.F. Goodchild, D.J. Maguire, D.W. Rhind, 2011, Geographic Information Systems and Science, 3rd edition, Wiley, 539 p.
2.	Lillesand T.M., Kiefer R.W., Chipman J.W., 2008, Remote Sensing and Image Interpretation, Sixth Edition, John Wiley & Sons, Inc., 756 p.
3.	Isaaks E. H., Srivastava R. M. Applied Geostatistics, 1989.
4.	Mozgeris G., Dumbrauskas A., Geoinformacinių sistemų pagrindai. Mokomoji knyga, Lietuvos žemės ūkio universitetas, Kaunas, 2008, 186 p.
5.	D.J. Maguire, M. Batty, M.F. Goodchild (eds.), 2005, GIS, Spatial Analysis, and Modeling,

	ESRI Press, 480 p.
6.	M. Zeiler, Modeling Our World. THe ESRI Guide to Geodatabase Design, ESRI Press, 199 p.
7.	A. Mitchell, The ESRI Guide to GIS Analysis Volume 1: Geographic Patterns & Relationships, 186 p. [http://www.amazon.com/ESRI-Guide-GIS-Analysis-Relationships/dp/1879102064#reader_1879102064]
8.	A. Mitchell, (2005), The ESRI Guide to GIS Analysis, Volume 2: Spatial Measurements and Statistics, ESRI Press, 252 p.
9.	A. Mitchell, (2012), The Esri Guide to GIS Analysis, Volume 3: Modeling Suitability, Movement, and Interaction, ESRI Press, 432 p.

Supplementary reference materials

No.	**Authors of publication, title, publishing house, year of publication.**
1.	G.Mozgeris, Geoinformatika aplinkotyroje, Vytauto Didžiojo universitetas, Kaunas, 2008, 228 p.
2.	G.Mozgeris, Ekologijoje ir aplinkotyroje naudojami šiuolaikiški erdvinės analizės metodai ir jų praktinis panaudojimas, Vytauto Didžiojo universitetas, Kaunas, 2008, 104 p.
3.	Mozgeris G., Augustaitis A., Jonikavičius D., Bosas G., Darbo ArcGIS 10 programine įranga pagrindai. Praktinių darbų aprašas, Lietuvos žemės ūkio universitetas, Aplinkos institutas, Miškų ir ekologijos fakultetas, 2011, 159 p.
4.	Scientific publications from Science Direct, EBSCOhost Web

Course programme designed by

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