COURSE OUTLINE

1. Study programme information

1.1 Higher education institution	Universitatea de Vest din Timişoara
1.2 Faculty / Department	Chimie, Biologie, Geografie / Departamentul de Geografie
1.3 Sub-department	Geografie
1.4 Field of study	Geography
1.5 Level of study	Master's degree
1.6 Study programme / Qualification	Geographic Information Systems

2. Course information

2.1 Course title				**Databases**			
2.2 Course convenor/ Lecturer				Drd. Ing. Ion-Alexandru MECA			
2.3 Teaching assistant				Drd. Ing. Ion-Alexandru MECA			
2.4 Year of study	1	2.5 Semester	2	2.6 Type of assessment	E	2.7 Course type	DS/DO

3. Total estimated time (hours of didactic activities per semester)

3.1 Number of hours per week	3	of which: 3.2 lecture	1	3.3 practical activity	2
3.4 Total hours in the curriculum	42	of which: 3.5 lecture	14	3.6 practical activity	28
Time distribution:					**hours**
Studying textbooks, course materials, bibliography and notes					25
Further research in libraries, on electronic platforms and in the field					25
Preparing seminars/ laboratories, homework, research papers, portfolios and essays					15
Tutoring					9
Examinations					9
Other activities ……					

3.7 Total hours of individual study	**83**
3.8 Total hours per semester	**125**
3.9 Number of credits	**5**

4. Prerequisites (if applicable)

4.1 based on curriculum	Introduction to databases; Basics in informatics; Geographic Information Systems; Geoinformatics
4.2 based on competencies	Basic skills of programming; analytical spirit and the ability to break down problems into sub-problems

5. Conditions (if applicable)

5.1 for the course	• Computer / laptop for the teacher and students • internet access; access to Google classroom • video projector
5.2 for the practical activity	• complete fulfilment of tasks of laboratory work and projects • Computer / laptop for the teacher and students. • internet access; access to the Google classroom; • video projector

6. Objectives of the discipline - expected learning outcomes to the formation of which contribute to the completion and promotion of the discipline

Knowledges	• Advanced knowledge on computer science and Spatial Databases for GIS • Concepts related to the structure and operation of a spatial database as a base for GIS systems. • Concepts and methodologies regarding the design and spatial database implementation • Understanding spatial support, spatial data types and database programming
Skills	• Use SQL database programming language for Spatial Databases: ▪ Spatial data types: geography, geometry with sub-type like Point, Polygon, LineString. Raster support. ▪ Projections support on Spatial Databases ▪ Spatial Queries: measuring distance, accessing and editing spatial data tables, querying shapefile attributes and geometry, import shapefiles to spatial databases, adding fields, merging and splitting geometries, geo-fence analysis, performing selections, attribute selections, dot density calculations, geocoding, overlay analysis. ▪ Raster Analysis: importing raster, query raster tables, map algebra, feature extraction, extract by mask, multi-criteria analysis based on spatial queries. ▪ LIDAR data support on spatial databases, performing spatial queries on LIDAR data, interpolation methods. ▪ Visualizing and analysis the results: creating rasters from vectors based on queries, choropleth maps, Web apps based on data from spatial databases
Responsibility and autonomy	• Development of a critical and analytical spirit among students; appreciating the advantages of using algorithmic thinking for spatial database design • The ability to solve specific Spatial Databases programming tasks autonomously. • The ability to identify/select appropriate solutions and generate innovative ideas. • The ability to correctly/effectively identify and plan tasks specific to a particular GIS project as a spatial database developer. • The application of effective and responsible work strategies, based on the principles, norms and values of the code of professional ethics. • Application of effective work techniques in a multidisciplinary team, ethical attitude, respect for diversity and multiculturalism, acceptance of diversity of opinion • Self-assessment of the need for continuous professional training for the purpose of insertion and adaptability to the requirements of the labour market

7. Content

7.1 Lecture	**Teaching methods**	**Observations**
1. Spatial Databases, geometry and geography data types. Raster data types	Lecture, Interactive presentations, heuristic conversation, problematization and hands-on examples	2 hours
2. Spatial database design concepts		2 hours
3. PostGIS and spatial support on PostgreSQL		2 hours
4. Geometries data operations (Queries)		2 hours
5. Spatial databases - Raster support & Analysis		2 hours
6. PostgreSQL & PostGIS LIDAR support		2 hours
7. Spatial databases integration with QGIS and ArcGIS Pro		2 hours

Bibliography

- Mastering PostGIS By Dominik Mikiewicz | Tomasz Nycz | Michal Mackiewicz Publication Date: 2017-05-31
- PostGIS Essentials by Angel Marquez
- PostGIS Cookbook - Second Edition By Mayra Zurbaran , Pedro M. Wightman , Paolo Corti
- Mastering PostgreSQL 9.6 By Hans-Jürgen Schönig
- Discover QGIS 3.x - Second Edition by Kurt Menke
- Introduction to QGIS Open Source Geographic Information System by Scott Madry Ph.D.

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The Accuracy Of Spatial Databases By Michael F. Goodchild, Sucharita Gopal
GDAL - https://gdal.org/
Focus on Geodatabases in ArcGIS Pro By David W. Allen
Course and practical activity materials, presentations and references posted on Google classroom.

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<tr><td>7.2 Practical activity</td><td>Teaching methods</td><td>Observations</td></tr>
<tr><td>1. GIT versioning. Spatial database design and implementation. Abstract database model, Conceptual model, spatial database implementation using spatial data types and PostGIS on PostgreSQL.</td><td rowspan="7">Hands-on exercises, case studies, scientific explanation and demonstration.</td><td>4 hours</td></tr>
<tr><td>2. Importing spatial data. Importing flat data. Import using shp2psql. Import using PostgreSQL clients</td><td>4 hours</td></tr>
<tr><td>3. Spatial Data Analysis. Composing and decomposing geometries. Spatial measurements, Geometry validation, Intersecting geometries. Nearest features queries.</td><td>4 hours</td></tr>
<tr><td>4. Data processing- vector operations. Obtaining and importing data. Merging, Slicing, Buffering geometries. Reprojecting geometries. Spatial relationships.</td><td>4 hours</td></tr>
<tr><td>5. Data processing – raster operations. Preparing data. Processing and analysis. Raster statistical functions. Vector to raster conversion. Raster to vector conversion. Spatial relationships.</td><td>4 hours</td></tr>
<tr><td>6. LIDAR processing: LIDAR data import, Spatial LIDAR queries. Data export: exporting data using GIS clients, exporting using GDAL, exporting using psql, exporting using PostgreSQL backup functionality</td><td>6 hours</td></tr>
<tr><td>7. Create QGIS project based on PostgreSQL spatial database. Explore spatial databases from ArcGIS Pro. Export QGIS project as a simple WebGIS application.</td><td>2 hours</td></tr>
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8. Corroborating course content with the expectations held by the representatives of the epistemic community, professional associations and typical employers in the field of the study programme.

The content of the discipline was developed in accordance with the curriculum and meets the didactic and scientific requirements corresponding to similar specializations in other university centres. Databases facilitates the acquisition of knowledge in carrying out a research project, both from a theoretical point of view and from the point of view of working methods in the field, developing students' analytical thinking, the ability to problematize, to manage a scientific approach, of a database and its operation. The software used in the practical applications are among the most modern and frequently used in specialized institutions. Such applied training makes students compatible with the job market in the field of geographic information systems, or research activity.

9. Assessment

Type of activity	9.1 Assessment criteria	9.2 Assessment methods	9.3 Weight in the final mark
9.4 Lecture	Understanding and assimilation of knowledge	Oral evaluation	20%
9.5 Practical activity	Individual or group (2-3 students) project	Evaluation of: - Database complexity - Database functionality	80%
9.6 Minimum performance standard			
• Minimum mark 5 at course evaluation. • Minimum mark 5 at practical activities.			
Additional information. • Courses will be held in modular format during weekends, with students agreement.			

Date

22.01.2024

Course convenor's signature

Drd. Ing Ion- Alexandru MECA

Date of approval in the department

Head of department's signature