COURSE DESCRIPTION CARD - SYLLABUS

Course name

GIS with Enviromental Engineering

Course

Field of study

Environmental Engineering Second-cycle Studies

Area of study (specialization)

Water Supply, Water and Soil Protection

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/1

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

Number of hours

Lecture

15

Tutorials

Laboratory classes

15

Projects/seminars

Other (e.g. online)

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

dr inż. Alicja Bałut

email: alicja.balut@put.poznan.pl

tel.61 6652079

Faculty of Environmental Engineering and Energy

ul. Berdychowo 4, 61-131 Poznań

Responsible for the course/lecturer:

Prerequisites

1.Knowledge: Basic knowledge acquired at courses delivered earlier during First cycle studies of Water Supply Systems, Cartography.

2.Skills :Use of knowledge obtained and ability to work in Microsoft Office Access or Excel, Word, Power Point, simple query in the Excel / Access database.

3.Social competencies:

Is aware of the need to expand their related competences with the progress of GIS technology and the computerization of water and sewage industry.

Course objective

To familiarize students with the possibilities of using the tools of spatial information systems (GIS) in environmental engineering. Acquiring knowledge about basic types of spatial data models together with the possibilities offered by GIS tools for conducting spatial and descriptive data analyzes. Practical implementation of tasks using spatial information systems to solve selected tasks related to the operation and management of the water supply system will allow you to acquire the ability to create vector and raster maps, and use various techniques of visualization of spatial data.

Course-related learning outcomes

Knowledge

1. Student knows the structures of databases used for the needs of design and operation of water supply systems and sewage system. Has knowledge related to the use of GIS for, for example, know how to simulate model of any elements of water supply and sewage networks using GIS elements (effects obtained during the lecture and during the laboratory). - [[KIS2_W05].]

2. Student is aware of what capabilities of the GIS system can be used to model the operation of individual devices and which data from the GIS system should be associated with a given device or facility of the water treatment and distribution system as well as objects related to sewage systems (effects obtained during the lecture). - [[KIS2_W02, KIS2_W06].]

3. Student knows the basic techniques, methods and IT tools used to integrate databases, geo-coding, improve the quality of databases and how to verify and update spatial and descriptive data (effects obtained during the lecture and during the laboratory). - [[KIS2-W05].]

4. Student knows the basic differences and concepts of basic spatial data models of GIS systems (raster, vector, hybrid, TIN, digital terrain model) knows their advantages and limitations. - [[KIS2_W07].]

Skills

1. Student is able to prepare a database of vector and raster layers presenting elements of various systems in environmental engineering, e.g. water supply and sewage networks, (effects obtained during laboratory exercises). - [[KIS2_U01].]

2. Student is able to perform spatial and descriptive analyzes in the GIS database (effects obtained during laboratory exercises). - [[KIS2_U04].]

3. Student is able to build the basic structure of input data necessary to build a computer simulation model of a water supply system (effects obtained during lectures and laboratory exercises). - [[KIS2_U03].]

4. Student understands the need to check and verify the analysis results obtained (effects obtained during laboratory exercises). - [[KIS2_U09].]

Social competences

1. Student is prepared to formulate and convey information and opinions on the achievements of technology and other aspects of engineering activities in a way that is universally understandable. - [[KIS2_K05].]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:

Exam, lasting 60 minutes, on the date specified at the beginning of the semester.

The exam is in the test form with multiple-choice questions. Aims to check the knowledge acquired during lectures

The scale of grades used is: The scale of grades used is (NB; 2.0; 2.5; 3.0; 3.5; 4.0; 4.5; 5.0). To pass the project it is necessary to obtain 50% correctly completed tasks.

Laboratory exercises:

Continuous assessment of the progress of work carried out in each class - rewarding activity

Colloquium from the last class in the form of practical test questions, to which answers are obtained by completing tasks in the QGIS / ArcGIS application.

Grading scale used: (NB; 2.0; 2.5; 3.0; 3.5; 4.0; 4.5; 5.0) To pass the project it is necessary to obtain 50% of correctly completed tasks.

Programme content

Lectures:

1. Basics and history of GIS spatial information systems. Legal status of GIS in Poland. Regulations regarding the creation and maintenance of GIS databases (SIP, SIT). Integration of space and information. Basic properties of spatial data. INSPIRE Directive. Database structures used in water supply and sewage systems.

2. Reference systems and positioning.

3. Numerical models of land surface (types, methods of construction and use in environmental engineering. Methods of interpolation and approximation of land height and sources of data for TIN construction).

4. Division of the system into basic spatial data models (raster, vector, hybrid). Characteristics of each of them and their spatial and descriptive attributes. Data sources for their construction of the GIS database (measurements, GPS, digitization, LIDAR).

5. Basic function of raster analysis (local, neighbourhood, zonal, global functions). Spatial data transformations. Transformations of point, line and surface data. Format conversion, vectorization. Topology of GIS system objects. Building possible spatial and descriptive queries to the GIS database.

6. Ways to visualize results, create maps. Geostatistical modelling and data analysis (variogram, estimation point environment, spatial variability analysis, kriging).

7. Network analysis on the example of QGIS, ArcGIS.

8. Application of GIS in modelling of water supply and sewage systems. Ways to verify input data.Geocoding - methods for assigning geographical coordinates and water demand to postal addresses.

9. The use of GIS systems to solve problems in environmental engineering, especially in the economy related to water resources management, ecology and environmental protection.

10. Maps and reference databases in the national spatial information system. Reference databases including BDOT. Geo-portals of reference maps. National thematic maps and thematic databases. Interactive GIS online. Available spatial data at European and global level.

Topics of laboratory exercises:

1. Introduction to the GIS system applications (specification of tasks: setting up the project, adding a new raster layer, adding an example vector layer, reading attributes assigned to objects (by pointing to the object), reading attributes in the table, group selection of objects, adding objects, editing vertices, moving objects, building a new layer, vectorizing the map, generating style for layers, creating labels, map print settings).

2. Spatial data analysis (creating filters in the open attribute table, generating a new layer from the selecting's results, field calculator, basic geoprocessing tasks: creating a buffer, clip layers, geometric difference, intersection of layers).

Teaching methods

1. Lecture: The content is transmitted in the form of a multimedia presentation. Selected issues are discussed in terms of problems.

2. Laboratory exercises: The content of the issues discussed and their detailed description of performance is included in the presentations given by the lecturer. A description of the tasks to perform the last two tasks is on the eMoodle platform, to which students have unlimited access. The tasks are carried out in the computer laboratory, each student works individually on his computer.

The person using the projector with a connected computer during the first 30 minutes presents, explains how to perform specific tasks using the QGIS / ArcGIS application. Then, within the next 60 minutes, students are required to perform specific tasks during each exercise on the topics presented by the lecturer

Bibliography

Basic

1. P.A. Longley, M.F. Goodchild, D.J. Maguire, D.W. Rhind, GIS- teoria i praktyka, PWN, Warszawa, 2006.

2. J. Urbański, GIS w badaniach przyrodniczych, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk, 2008.

3. M. Kwietniewski, GIS w wodociągach i kanalizacji, PWN, Warszawa, 2008.

Additional

1. P.F. Boulos, K.E. Lansey, Comprehensive Water Distribution Systems analysis Handbook for engineers and planners, MWH Soft, California, USA, 2006.

2. T. Kubik, GIS- Rozwiązania sieciowe, Wydawnictwo Naukowe PWN, Warszawa, 2009

3. A. Magnuszewski GIS w geografii fizycznej, Wydawnictwo Naukowe PWN, 1999.

4. J. Ładysz,Technologia GIS w Inżynierii Bezpieczeństwa, Wrocław, 2015.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests) [1]	20	1,0

[1] delete or add other activities as appropriate