National Technical University of Ukraine
"KYIV POLYTECHNICAL INSTITUTE
in the name of IGOR SIKORSKY "

Department of
Geoengineering

Geoinformation systems of subsoil use

Work program of the discipline (Syllabus)

Details of the discipline

Level of higher education	***Second (master's)***
Branch of knowledge	*18*
Specialty	*184 Mining*
Educational program	*Certificate program "Resource-saving technologies of subsoil use"*
Discipline status	*Selective*
Form of study	*Full-time (day) / full-time (evening) / part-time / remote / mixed*
Year of preparation, semester	*5th year, spring semester*
The scope of discipline	*4 credits*
Semester control / control measures	*Credit /MTW(modular test work)*
Lessons schedule	*http://rozklad.kpi.ua/*
Language of instruction	*Ukrainian*
Information about course leader / teachers	Lecturer: Candidate of Technical Sciences, Associate Professor Hrebeniuk Tetyana Volodymyrivna, t.hrebeniuk07@gmail.com, 0679416841; Practical / Seminar: Ph.D., Associate Professor Hrebeniuk Tetyana Vladimirovna, t.hrebeniuk07@gmail.com, 0679416841;
Course placement	Available on the Sikorsky platform. The access code is provided by the teacher in the first lesson.

Curriculum

1. Description of the discipline, its purpose, subject of study and learning outcomes

The urgency of the discipline determines the high level of development of information technology in all spheres of activity, as well as Ukraine's European integration aspirations and the need to adhere to the principles of sustainable economic development. Study of different areas of geoinformation research and tasks of geoinformatics as a science, coverage and mastering of the structure and classification of geoinformation systems in subsoil use (GIS), the functionality of GIS technological units.

The purpose of the discipline – *acquaint students with the basic principles, methods and capabilities of geographic information technology, existing examples and tools that implement GIS technology, to instill in them the practical skills of using these tools in conducting geographic information research.*

The subject *of study are geological objects in terms of factual description, storage of information, presentation, modeling and analysis using GIS-technologies, as well as the methodology of GIS in solving a number of scientific and practical economic problems (flood prevention, territory, selection of the optimal from the engineering-geological point of view option of location of the engineering structure, etc.)…*

Program learning outcomes.

Ability to use in-depth theoretical and fundamental knowledge, skills and abilities to successfully solve complex specialized problems and practical problems of subsoil use using modern geographic information technologies, theoretical positions and methods of geophysical surface research, to solve various scientific and practical problems and in the learning process, which involves the use of basic theories and methods.

Be able to use methods and technologies of land management design, territorial and economic land management, land use planning and protection. Know the specialized GIS software, systems and basic skills to handle GIS portals of minerals to solve applied professional problems.

2. Prerequisites and postrequisites of the discipline (place in the structural and logical scheme of education according to the relevant educational program)

To successfully master the discipline the student must have basic knowledge of "Geophysics", "Geodesy", "Computer Science", "Ecology", etc.

3. The content of the discipline

Topic 1. Basic concepts of GIS.

Topic 2. Geographic information system of mineral deposits.

Topic 3. Classification and cartographic overlay in GIS.

Topic 4. GIS in the geological field.

Topic 5. Hardware of geographic information systems and technologies.

Topic 6. Cartography. Map properties and functions.

Topic 7. Methods of cartographic image.

Topic 8. Submission of information in GIS. Visualization of information in GIS

4. Training materials and resources

Basic literature

1. *The NCGIA Core Curriculum in GIScience [Electronic resource] / M. F. Goodchild, K. K. Kemp, eds. – NCGIA University of California, Santa Barbara CA., 2000. – Access mode: http://www.ncgia.ucsb.edu/. – Title from the screen.*
2. *David J. Buckley. The GIS Primer [Electronic resource] / David J. Buckley. – Access mode: http://www.innovativegis.com/education/primer.html. – Title from the screen.*
3. *Joseph K. Berry. Beyond Mapping III. Understanding Spatial Patterns and Relationships [Electronic resource] / K. Joseph. – BASIS Press, 2007, 227 p. – Access mode: http://www.innovativegis.com/basis/MapAnalysis/]. Title from the screen.*
4. *Principles of Geographic Information Systems / Rolf A. de By (ed.). – ITC, Enschede, The Netherlands. – 490 p.*
5. *GIS Glossary [Electronic resource]. – Access mode: http://www.geog.ubc.ca/courses/klink/gis.notes/glossary.html. – Title from the screen; Spatial Analysis and GIS: A Primer / Gilberto Camara and other. – Image Processing Division, National Institute for Space Research (INPE), Brazil.*

Additional literature

6. *Cheng G. Hierarchy Representation of Virtual Terrain Environment and Research into the Real Time Shading Technology: Ph. D. thesis / Zhengzhou Institute for Mapping and Surveying. – Zhengzhou, 2000. – 133 p.*
7. *David DiBiase, Michael DeMers, Ann Johnson, Karen Kemp, Ann Taylor Luck, Brandon Plewe, and Elizabeth Wentz – Geographic Information Science & Technology. Body of Knowledge [Electronic resource]. – Access mode: http://www.ucgis.org/ – Title from the screen.*
8. *ArcGIS Desktop Help [Electronic resource]. – Access mode: http://webhelp.esri.com/arcgisdesktop/9.3/. – Title from the screen.*

9. *Kemp K. K. Developing a curriculum in Geographic Information Systems: The National Center for Geographic Information and Analysis Core Curriculum project / K. K. Kemp and M. F. Goodchild // Journal of Geography in Higher Education. – № 15. – 1991, (2). – P. 121–132.*

References can be found on the Internet. Literature, the bibliography of which does not contain references, can be found in the library of KPI. Igor Sikorsky.
Separate sections of the basic literature [1] - [5] are obligatory for reading. All other literature sources are optional, it is recommended to read them.

Educational content

5. Methods of mastering the discipline (educational component)

Lectures

№ з/п	Title of the lecture topic and list of main questions (references)
Lecture 1	**Basic concepts of GIS** The process of converting data into information. Geographic information technologies in the modern world. The concept of geographic information systems. Informatics, geoinformatics, geoinformation technologies and geography. **Literature:** [1,3]
Lecture 2	**Information systems, their classification and components.** Difference of GIS from other information systems. History of geoinformation technologies development. Functions and areas of application of GIS and geoinformation technologies. Classification of modern GIS. The concept of geodata **Literature:** [1,2,3]
Lecture 3	**The concept of geoinformation.** Definition of GIS. Areas of application of GIS. GIS components and information support. Hardware and software. **Literature:** [1,3,5]
Lecture 4	**Geoinformation system of mineral deposits. GIS portals.** Possibilities of geographic information system. Geoinformation system of mineral deposits is an effective tool for subsoil use management. Services that precede the creation of GIS. **Literature:** [4,5,9]
Lecture 5	**Spatial map binding.** Management of the cartographic database of the enterprise. Digitization of documents. Geoinform of Ukraine database. **Literature:** [1,5]
Lecture 6	**Classification and cartographic overlay in GIS.** The concept of natural breakdown, quantiles, equal intervals, standard deviation. Cartographic overlay and its types. **Literature:** [4,5]
Lecture 7	**GIS in the geological field.** The purpose of exploration work. Users of information in the geological field. Examples of GIS application in the environmental sphere in Ukraine. The use of GIS in solving environmental problems. **Literature:** [1,3,4]
Lecture 8	**Hardware of geographic information systems and technologies.** General characteristics of GIS hardware. Devices for collecting and entering information. Devices digitizers, scanners, GPS receivers. **Literature:** [2,5,7]
Lecture 9	**Hardware of geographic information systems and technologies.** Electronic surveying instruments, visualization and data representation devices, stereophotogrammetric stations, displays, printers and plotters.

	Literature: [1,3,8]
Lecture 10	**Cartography** **Map properties and functions** Classification of geographical maps. Methods of generalization. Semantic generalization and its types. **Literature:** [1,6]
Lecture 11	**Ways of cartographic image.** Method of localized icons, Method of linear icons, Method of qualitative and quantitative background, Method of isolines, Method of habitats, Point method, Cartograms and Map diagrams. **Literature:** [6,9]
Lecture 12	**Relief image.** Ways to depict the terrain. The method of elevations. Hipsometric method. Plastic methods. Block diagrams, relief models, relief maps, digital relief models. **Literature:** [2,6,9]
Lecture 13	**Remote sensing as one of the important methods of geological research.** Types of space images and their qualitative characteristics. Decryption of natural and anthropogenic objects. **Submission of information to GIS.** Visualization of information in GIS **Literature:** [6,9,10]
Lecture 14	**Submission of information to GIS.** Representation of screen views (windows). Representation of vector objects. Presentation of surfaces and raster maps. **Literature:** [6,10]

Practical training

№ s/p	Tasks for practical classes
Practice session 1	Purpose and capabilities of GIS software and hardware tools.
Practice session 2	Acquaintance with the GIS portal for monitoring the use of subsoil of Ukraine (https://minerals.rnbo.gov.ua/main)
Practice session 3	Exploring the capabilities of the ArcView GIS dialog and software interface (http://www.geoguide.com.ua/software/software.php?part=esri&art=esri)
Practice session 4	Perform basic operations on working with spatially coordinated data based on the ArcView GIS interface
Practice session 5	Analysis of thematic layers of the GIS project, determination of positional and non-positional characteristics of objects
Practice session 6	Working with a public GISFile map (http://gisfile.com/publicmap.htm?sl=UA.)
Practice session 7	GIS data entry and raster binding. Analysis of terminological definitions of geographic information systems, using various sources.
Practice session 8	Creating a digital map: connecting a raster substrate, creating object tables.
Practice session 9	Digital map creation: vectorization of data with the creation of spatial objects of point type geometry.
Practice session 10	Creation of GIS project of geological information. Analysis of the use of different standards and data formats for the creation of geographic information projects, export and import of data and exchange of geological information.
Practice session 11	Creation of GIS project of geological information. Defining a data representation model.

Practice session 12	Reports, discussion of lecture material.
Practice session 13	*MTW(modular test work)*
Practice session 14	Test

6. Independent work of a student / graduate student

The student's independent work involves:

preparation for classroom classes - 16 hours;

preparation for modular control work - 2 hours;

preparation for the test - 2 hours.

Policy and control

7. Policy of academic discipline (educational component)

At the time of each lesson, both lecture and practical, the student must have the Zoom application installed on the device from which he works, as well as open the course "Geographic information systems of subsoil use" on the platform "Sikorsky" (access code to the course is provided on the first lesson according to the schedule). Classes according to the schedule are conducted using the Zoom application (subject to distance learning). Syllabus; lecture material; tasks for each practical lesson; options of modular control work; tests to be performed at each lecture; variants of test control work are placed on the platform "Sikorsky" and in the system "Electronic Campus KPI".

During the course "Geoinformation systems of subsoil use" students are required to adhere to the general moral principles and rules of ethical conduct specified in the Code of Honor of the National Technical University of Ukraine "Kyiv Polytechnic Institute named after Igor Sikorsky".

Deadlines for each task are indicated in the course "Geoinformation systems of subsoil use" on the platform "Sikorsky".

All students, without exception, are obliged to comply with the requirements of the Regulations on the system of prevention of academic plagiarism at the National Technical University of Ukraine "Kyiv Polytechnic Institute named after Igor Sikorsky".

8. Types of control and rating system for evaluation of learning outcomes (RSO)

Current control: survey on lecture material (4 surveys × 8 points = 32 points), tasks within the practical lesson (12 practical lessons × 4 points = 48 points), MCR (conducted in a practical lesson, 20 points).
Calendar control: conducted twice a semester as a monitoring of the current state of compliance with the requirements of the syllabus.
The condition for a positive first calendar control is to obtain at least 33 points, the second calendar control - to obtain at least 53 points.
Semester control: credit.
Conditions of admission to the semester control: semester rating more than 36 points.
The sum of rating points received by the student during the semester is transferred to the final grade according to the table. If the sum of points is less than 60, but the semester rating is more than 36 points, the student performs a test. In this case, the sum of 36 points and points for the test is transferred to the final grade according to the table.
A student who received more than 60 points in the semester, but wants to improve his score, can take part in the test. In this case, the final result consists of the points obtained in the test, and a minimum of 36 points.
The test is estimated at 64 points. The control task of this work consists of two theoretical questions from the list provided in the appendix to the syllabus and the problem.
Each theoretical question is evaluated in 20 points according to the following criteria:

- *"excellent" - complete answer (at least 90% of the required information), provided appropriate justifications and personal opinion - 20 - 18 points;*
- *"good" - a sufficiently complete answer (at least 75% of the required information), which is performed in accordance with the requirements for the level of "skills" or contains minor inaccuracies - 17 - 15 points;*
- *"satisfactory" - incomplete answer (not less than 60% of the required information), performed in accordance with the requirements for the "stereotypical" level and contains some errors - 14 - 12 points;*
- *"unsatisfactory" - unsatisfactory answer - 0 points.*
- *The task is evaluated in 24 points according to the following criteria:*
- *"excellent" - a complete answer (at least 90% of the required information), provided appropriate justification and personal opinion - 24 - 22 points;*
- *"good" - a sufficiently complete answer (at least 75% of the required information), which is performed in accordance with the requirements for the level of "skills" or contains minor inaccuracies - 21 - 18 points;*
- *"satisfactory" - incomplete answer (not less than 60% of the required information), performed in accordance with the requirements for the "stereotypical" level and contains some errors - 17 - 15 points;*
- *"unsatisfactory" - unsatisfactory answer - 0 points.*

Table of correspondence of rating points to grades on the university scale:

Scores	Rating
100-95	Perfectly
94-85	Very good
84-75	Fine
74-65	Satisfactorily
64-60	Enough
Less than 60	Unsatisfactorily
Admission conditions are not met	Not allowed

9. Additional information on the discipline (educational component)

The list of questions submitted for semester control is given in the appendix to the syllabus.

Work program of the discipline (syllabus):
Compiled by Ph.D., Associate Professor Hrebeniuk T.V.
Approved by the Department of Geoengineering (protocol № 7 08.12.2021)
Approved by the IEE Methodological Commission (protocol № 6 24.12.2021)