Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Department of geoengineering

Special methods of construction

Working program of the academic discipline (Syllabus)

Educational detailsdisciplines	
Level of higher education	***Second (master's)***
Branch of knowledge	*18 Production and technologies*
Specialty	*184 Mining*
Educational program	*Geoengineering*
Discipline status	*Normative*
Form of education	*full-time/part-time*
Year of training, semester	*1st year, spring semester*
Scope of the discipline	*3.5 credits/105 hours (lectures - 27 hours, practical - 27 hours, independent work - 51 hours)*
Semester control/ control measures	*Exam/MCR/Report*
Lessons schedule	*http://roz.kpi.ua*
Language of teaching	*Ukrainian, English*
Information about the course leader / teachers	Lecturer: Doctor of Technical Sciences, Zuievska Natalia Valerievna, (+38)0509821770, znata1770@gmail.com Laboratory / Seminary Doctor of Technical Sciences, Zuievska Natalia Valerievna, (+38)0509821770, znata1770@gmail.com
Placement of the course	https://classroom.google.com/u/1/c/NDg2MTE0NjkzMjUw

Educational programdisciplines

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

A specialist who has modern theoretical and practical views on special methods and methods of construction of underground structures.

the purpose*teaching the educational discipline "Special methods of construction" is the formation of students' abilities to professionally possess profiled knowledge and practical skills in the construction of underground structures using special methods, to have basic knowledge of fundamental sciences to the extent necessary for mastering general professional disciplines, to choose methods and methods of soil consolidation when passing underground workings.*

subject*the study of the discipline has special methods and methods of construction of underground structures.*

Software competencies

SK1. Ability to identify, pose, solve problems and make informed decisions in professional activities.

SK2. Ability to perform theoretical and experimental studies of parameters and modes of operation of systems and technologies of mining and geoconstruction enterprises;

SK5. Ability to organize production processes and technical management of systems and technologies of

mining and geoconstruction enterprises

SK6. Ability to carry out design works of special methods of construction, objects of mineral development, take special measures for the reconstruction of underground structures and mining enterprises.

Program learning outcomes.

PH7. To carry out theoretical and experimental studies of parameters and modes of operation of systems and technologies of mining and geoconstruction enterprises;
PH10. Organize production processes and technical management of systems and technologies of mining and geoconstruction enterprises
PH11. Carry out design works for special construction methods, mineral development facilities, take special measures for the reconstruction of underground structures and mining enterprises

know: *methods of construction of urban underground structures by special methods, which are used in difficult geological conditions, in conditions of dense urban development and in the construction of special purpose objects; skills of a design engineer in the field of underground construction.*

be able*: identify, pose, solve problems and make informed decisions in professional activities, namely: use basic knowledge of fundamental sciences to the extent necessary for mastering general professional disciplines; choose constructive schemes*
"wall in the soil" depending on the geological conditions and purpose of the structures; substantiate special construction methods when erecting underground structures; choose a method of securing the soil massif during mining; apply the acquired theoretical knowledge in the substantiation and design of underground structures and special purpose objects in the conditions of dense urban development and in complex mining and geological conditions.

2. Pre-requisites and post-requisites of the discipline (place in the structural and logical scheme of training according to the relevant educational program)

Prerequisites*: It is based on the study of the disciplines "Reconstruction of underground structures", "Special course of underground construction" and individual sections of the educational components of the autumn semester.*

Post-requisites:*in the structural and logical scheme of the specialist training program, the discipline is one of the final ones in the formation of a master's degree in mining.*

3. Content of the academic discipline

Topic 1. Basic information about special construction methods.
topic 2. Construction of mine workings with the help of sheet metal fencing.
Topic 3. Construction of mining works by the "Wall in the soil" method.
Topic 4. Construction of mining works with the use of drop fixing.
Topic 5. Construction of mine workings under compressed air (caisson method).
Modular control work 1 on 1 - 5 topics
Topic 6. Construction of mining works using water lowering.
Topic 7. Construction of mining works using rock freezing.
Topic 8. Construction of mining works using rock tamping.
Topic 9. Special explosive technologies in geoengineering.
Modular control work 2on 6 - 9 topics
Abstract
Exam

4. Educational materials and resources

Basic literature:

1. *Zuievska, N. Impact of low frequency dynamic loading on structural health of existing reinforced concrete railway retaining walls in the foothills of the Carpathians/ I. Kaliukh, O. Lebid, O. Chala, A. Kryvoruchko, N. Zuievska// European Association of Geoscientists & Engineers/ Conference Proceedings, International Conference of Young Professionals «GeoTerrace-2021», Oct 2021, Volume 2021, p.1 – 5*
   https://doi.org/10.3997/2214-4609.20215K3046
2. *Zuievska, N. Modeling of the effect of a high-pressure jet of cement mortar on the surrounding soil environment when performing jet grouting columns using jet technology/ Zuievska N., Gubashova V., Korobiichuk V.// E3S Web of Conferences 280, 03001 (2021). ICSF 2021*
   https://doi.org/10.1051/e3sconf/202128003001
3. *Investigation of the Effect of Soil and Wall Interaction on the displacement of Retaining Walls Using Finite Element Method/June 2016Bulletin de la Societe Royale des Sciences de Liege 85:1-7*

   DOI:10.25518/0037-9565.5117

Additional literature:

1. *Investigation of the Effect of Soil and Wall Interaction on the displacement of Retaining Walls Using Finite Element MethodJune 2016Bulletin de la Societe Royale des Sciences de Liege 85:1-7*

https://doi.org/10.3208/sandf.44.87

2. *DBN V.2.1-10:2018 Basics and foundations of construction structures. Substantive provisions.*
3. *DBN A.2.1-1-2008 Engineering searches for construction*
4. *DBN V.1.1-24:2009 Protection against dangerous geological processes. Basic provisions of design*
5. *DBN V.1.1-25-2009 Engineering protection of territories and structures against flooding and flooding*
6. *DBN V.1.2-2:2006 Loads and influences. Design standards*
7. *DSTU B A.1.1-25-94 Soils. Terms and definitions*

Educational content

To master the educational component, a partial-research method is used, which consists in organizing an active search for a solution to the educational (or self-formulated) cognitive tasks and the problem presentation method, in which students become witnesses and co-participants in the scientific search.

The name of the topic of the lecture and a list of main questions
(a list of didactic tools, references to the literature and tasks on the SRS)

Topic 1. Basic information about special construction methods.

Lecture 1. Place of special methods of construction. Their task.Brief information on engineering geology and hydrogeology. Classification of special methods of construction in difficult mining and geological conditions. History of the development of technology and techniques of special construction methods in our country and abroad [1, 4].

Topic 2. Construction of mining works with the help ofsheet pile fence.

Lecture 2. The essence of the method and scope of application. Structures of sheet pile fences. Equipment for sinking sheet piles.

Production technology of works in the construction of mining workings with the help of sheet metal fences [2].

Topic 3. Construction of mining works by the method"Wall in the soil".

Lecture 3. The essence of the method and scope of application. Terms of use. Construction of the fence. Technology

construction of a "wall in the soil" [2].

Topic 4. Construction of mining works fromusing a drop fastener.

Lecture 4. The essence of the method and scope of application. Structural elements of lowering structures. Technology
performance of work in various mining conditions [2].

Lecture 5. Drop fastening with forced compression. Drop fastening with reduced effect of frictional forces. Calculation of lower fastening [2].

Topic 5. Constructionof mining products under compressed air (caisson method).

Lecture 6. The essence of the method, scope and types of caissons. Equipment used. Technological schemes and the procedure for performing work during the construction of vertical structures [3].

Lecture 7. Peculiarities in the construction of horizontal mine workings under compressed air. norms industrial sanitation when working in a zone of increased pressure. Advantages and disadvantages [3]. MKR-1

Topic 6. Construction of mining works using water lowering.

Lecture 8. The essence of the method and scope of application. Types of wells for lowering water.Equipment and stages
water lowering The procedure for performing water lowering works and ways to increase the flow rate of the well [2].

Topic 7. Construction of mining works using rock freezing.

Lecture 9. The essence of the method and conditions of application. History of soil freezing technique. Types of methods
soil freezing [2].

Lecture 10. Brief description of the method of soil freezing. Theory of mechanics of frozen rocks. Physical and mechanical properties of frozen rocks [2].

Topic 8. Construction of mining works using rock tamping.

Lecture 11. The essence of the swabbing method. Brief description and scope of application of various types of tamponade.
Cementation. Claying Bituminization. Silicification. Resinization. Complex method of aquifer tamponaderocks [1].

Topic 9. Special explosive technologies in geoengineering.

Lecture 12. Physico-mechanical and dynamic properties of rocks. Low-speed explosive formulations substances for compaction of structurally unstable subsidence soils. The influence of ultrasonic radiation [1].

Lecture 13. Analytical and theoretical evaluations of explosive management capabilitiesparameters. Methods control of the explosive impulse during the elimination of subsidence properties of structurally unstable soils [1]. MKR-2

Lecture 14. Laboratory and landfill studies of compaction of structurally unstable soils with improved low density explosives. Seismic safety of technological explosions [1].

No s/p	Name of the subject of the lesson and list of main questions (a list of didactic support, references to the literature and tasks on the SRS)
1	Practical work #1. Calculation of the sheet pile fence
2	Practical work #2. Calculation of the wall in the soil
3	Practical work #3. Calculation of lower fastening (3 hours). Protection of the abstract
4	Practical work #4. Calculation of compressed air with the caisson method of construction of mining products (4 hours). Protection of the abstract
5	Practical work #5. Calculation of water-lowering installations (4 hours). Protection of the abstract
6	Practical work #6. Calculation of the freezing process (4 hours). Protection of the essay
7	Practical work #7. Designing tamponage works (4 hours). Protection of the abstract
8	Practical work #8. Calculation of the parameters of the explosive impulse at the boundary of the distribution explosive substance - soil massif (4 hours). Protection of the essay

5. Independent work of student

The student's independent work (SRS) includes: study of educational material, preparation for classroom classes, execution and preparation of an essay, preparation for the exam.

The curriculum provides for the writing of an essay by the student, for which 10 hours of independent work are allocated, preparation for the exam 30 hours, preparation for the MKR 4 hours, preparation for classroom classes 7 hours.

POLITICS AND CONTROL

6. Policy of academic discipline (educational component)

The system of requirements for the student.

- ***Attending classes is the main component****studying the material. Student rating is formed through active participation in practical classes, namely in solving practical tasks and individual work.*
- ***Students must follow the rules of conduct****in classes, according to Regulations on the organization of the educational process at Igor Sikorskyi KPI (https://kpi.ua/regulations) and the Principles of Academic Integrity or Moral and Ethical Standards of Conduct (https://kpi.ua/academicintegrity), in accordance with the normative legal documents of the University and the Rules of Education and Conduct at "KPI" . Igor Sikorsky".*
  l. In case of violation of the rules of behavior in classes, in accordance with the Regulation on the organization of the educational process in KPI named after Igor Sikorskyi, Principles of academic integrity or moral and ethical standards of conduct, non-fulfillment of conditions of admission to semester control, deadlines for completing tasks for improper reasons, the student may be assigned the grade: "Removed". At the lecture, the teacher uses his own presentation material; uses Google Class to teach the material of the current lecture, additional resources, etc.; the teacher opens access to a certain Google Class directory for downloading electronic essays and answers to the MKR.
  Abstract: students perform and draw up abstracts. Baliza abstractare taken into account only in the presence of electronic and printed versions.
  Modular control works write in lectures without the use of aids (mobile phones, tablets, etc.); the result is forwarded in a file to the appropriate Google Class directory. If the control measures are missed for valid reasons (illness or serious life circumstances), the student is given the opportunity to additionally complete the control task during the next week.

- ***Incentive points*** *are awarded for: active participation in lectures; preparation of reviews of scientific works; presentations on one of the topics of the discipline, etc.*
- ***Penalty points:*** *are not provided.*
- ***Policy of deadlines and rescheduling*** *is formed in accordance with the approved schedule of the educational process at the University (https://kpi.ua/year) and the Regulation on current, calendar and semester control of study results at KPI named after Igor Sikorskyi (https://kpi.ua/document_control). The schedule of deadlines and rescheduling in the academic discipline is presented in the Electronic Campus (https://ecampus.kpi.ua/) and in the dean's office of the faculty.*
- ***Academic Integrity Policy*** *applicants provide, in particular: independent performance of educational tasks, current and final tasks, control of learning results (for persons with special educational needs, this requirement is applied taking into account their individual needs and capabilities); references to sources of information in case of use of ideas, developments, statements, information; compliance with the legislation on copyright and related rights; provision of reliable information about the results of one's own (scientific, creative) activity, used research methods and sources of information.*

7. Types of control and rating system for evaluating learning outcomes (RSO)

Current control: MKR, abstract.
Calendar control: is carried out twice a semester as a monitoring of the current state of fulfillment of the syllabus requirements.
The condition for a positive first and second calendar control is to obtain at least 50% of the maximum rating possible at the time of the corresponding intermediate control.
Semester control: exam.
Conditions for admission to the semester control: a semester rating of more than 36 points and a completed and submitted essay.
The student's rating in the discipline consists of the points he receives for:

1) *Work in practical classes;*
2) *Abstract;*
3) *modular control works;*
4) *the answer to the exam.*

The system of rating (weighted) points and evaluation criteria The student's rating in the discipline consists of the following points:

1. *Work in practical classes.*
   The weighted point is 1. The maximum number of points in all practical classes is equal to: 1 point × 10 = 10 points
2. *Abstract.*
   The weighted score is 20.: 20 points×1=20 points

- "excellent" complete answer (at least 95% of the required information) – 19-20 points;
- "very good", complete answer with minor inaccuracies - 18-17 points;
- "good", sufficiently complete answer with minor inaccuracies (at least 75% of the required information) - 16-15 points;
- "satisfactory", incomplete answer (at least 65% of the required information) - 14-13 points;
- "enough", sufficient answer (at least 60% of the required information) - 12 points;

3. Modular control works.
The weighted point is 15. The maximum number of points for all test papers is equal to: 15 points × 2 = 30 points

- "excellent" complete answer (at least 95% of the required information) – 14-15 points;

- "very good", complete answer with minor inaccuracies - 13 points;

- "good", sufficiently complete answer with minor inaccuracies (at least 75% of the required information) - 12 points;

- "satisfactory", incomplete answer (at least 65% of the required information) - 10-11 points;

- "enough", sufficient answer (at least 60% of the required information) - 9 points;

4. Exam - 40 points.

At the exam, students answer 3 questions in writing, of which: 2 are theoretical, valued at 15 points, and a practical task, valued at 10 points. Answers are evaluated in 10 (15) points according to the following criteria:

- *"excellent", complete answer, at least 95% of the required information (complete, error-free solution of the task) – 9-10 (13-15) points;*
- *"very good", sufficiently complete answer, at least 85% of the required information or minor inaccuracies (complete solution of the task with minor inaccuracies) - 8-9 (12-13) points;*
- *"good", sufficiently complete answer, at least 75% of the required information or minor inaccuracies (complete solution of the task with minor inaccuracies) - 7-8 (10-12) points;*
- *"satisfactory", incomplete answer, at least 65% of the required information and some errors (the task was completed with certain shortcomings) - 6-7 (9-10) points;*
- *"enough", incomplete answer, at least 60% of the required information and some errors (the task was completed with certain shortcomings) - 5-6 (7-8) points;*
- *"unsatisfactory", the answer does not meet the conditions for "satisfactory" - 0 points.*

Bonus points for:

- *performance of tasks to improve didactic materials in the discipline is awarded from 5 to 10 incentive points.*

Calculation of the rating scale (R):

The sum of the weighted points of control measures during the semester is: 60 points.

The examination component of the scale is equal to 40% of R, namely:40

Thus, the rating scale for the discipline is: $R = RC + RE = 60 + 40 = 100$ points.

<u>For correspondence education.</u>

Current control: MKR (32 points), essay (28 points), exam (40 points). The structure of the ICR and the essay, requirements for them and evaluation criteria:

MKR (32 points):

- "excellent" complete answer (at least 95% of the required information) - 30-32 points;

- "very good", complete answer with minor inaccuracies - 26-29 points;

- "good", sufficiently complete answer with minor inaccuracies (at least 75% of the required information) - 23-25 points;

- "satisfactory", incomplete answer (at least 65% of the required information) - 20-22 points;

- "enough", sufficient answer (at least 60% of the required information) - 18-19 points;

Abstract (28 points):

- "excellent" complete answer (at least 95% of the required information) - 27-28 points;

- "very good", complete answer with minor inaccuracies - 24-26 points;

- "good", sufficiently complete answer with minor inaccuracies (at least 75% of the required information) - 21-23 points;

- "satisfactory", incomplete answer (at least 65% of the required information) - 18-20 points;

- "enough", sufficient answer (at least 60% of the required information) - 16-17 points; The sum of the weighted points of control measures during the semester is: 60

The exam is conducted in the same way as for full-time education.

Bonus points for:

- *performance of tasks to improve didactic materials in the discipline is awarded from 5 to 10 incentive points.*

The examination component of the scale is equal to 40% of R, namely: 40.

Thus, the rating scale for the discipline is: $R = R_C + R_E = 60 + 40 = 100$ points.

In order for the student to receive the appropriate grades (ECTS and traditional), his rating grade R is translated according to the table:

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 not met	Not allowed

9. Additional information on the discipline (educational component)

The list of questions submitted for semester control

1. Under what conditions are special construction methods used. What are their tasks
2. Analyze engineering geological and hydrogeological conditions of application of special construction methods
3. Give the classification of special methods of construction in difficult mining and geological conditions
4. Give the historical aspects of the development of technology and techniques of special construction methods in our country and abroad
5. Specify the classification, scope of application of the enclosing fastener. Analyze the driven sheet pile fastening.
6. What designs of sheet pile fences do you know? Give the diagrams.
7. How do you perform immersion and extraction of sheet piles
8. Analyze the construction of underground structures by the lowering method
9. What are the conditions for using a thixotropic shirt. Solutions for her.
10. List the structural elements of lowering structures
11. How is the development and transportation of the soil carried out when using a drop fastener.
12. Give the method of calculating the lowering structure
13. Analyze the construction by the "wall in soil" method
14. What technological stages of execution of monolithic concrete and reinforced concrete works of the "wall in soil" method do you know.
15. What elements does the reinforcing frame consist of? How the frames are joined. What butt joints are used when using the "wall in soil" method.
16. Give technological schemes for building a "wall in the soil" from reinforced concrete (give a graphic image). Reveal their essence.
17. Give technological schemes for building a "wall in the soil" by drilling methods (give a graphic image). Reveal their essence.
18. Analyze the construction of mine workings under compressed air
19. What elements make up the working chamber during construction under compressed air
20. State the operation modes of the compressor station during construction under compressed air
21. How is the penetration of products under compressed air

Working program of the academic discipline (syllabus):

Compiled by Professor, Doctor of Technical Sciences, Zuievska N.V.

Approved by the Department of Geoengineering (protocol No 18 17.06.2022)

Approved by the Methodical Commission of the SR IEE (Protocol No. 12 of 24.06.2022)