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

Department of Geoengineering

Construction of mining and technical facilities
Working program of the academic discipline (Syllabus)

Details of the Disciplines	
Level of higher education	***Second (Master)***
Branch of knowledge	*18. Production and technology*
Specialty	*184 Mining*
Educational program	*Geoengineering.*
Discipline status	*Compulsory*
Discipline scope	*full-time (full-time), part-time*
Year of study, semester	*1st year, fall semester*
Discipline scope	*4 credits ECTS*
Semester control / control measures	*Examination, Modular test, calculation and graphic work*
Lessons schedule	*http://rozklad.kpi.ua/*
Language of Lecture	*Englich*
Information about	*Lecturer: Associate Professor of the Department of Geoengineering, Candidate of Technical Sciences, Associate Professor Nataliya Ivanivna Zhukova,* *nataliaz127@ukr.net, +380676962433* *Practical / Seminars Associate Professor of the Department of Geoengineering, Candidate of Technical Sciences, Associate Professor Natalia Ivanivna Zhukova, nataliaz127@ukr.net, +380676962433*
course leader / lehrer	*Available on the Sikorsky platform. The access code is provided by the teacher at the first lesson.*

Program of the discipline

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

Mining enterprises have a complex complex of surface buildings and structures, which in some cases reaches up to 40% of the total cost of the enterprise. A modern mine or mine is a highly mechanized enterprise for the extraction and processing of minerals, and a significant part of the production processes is provided by the buildings and structures of the surface complex. Reducing the cost of construction of surface complex facilities depends on the application of modern methods of design and construction of mining facilities, which is the subject of study of the discipline.

The purpose of the educational discipline *is to study by students volume-planning solutions and methods of construction of mining facilities to ensure an effective technological complex of the surface of mining enterprises and subways.*

The subject of the study of the discipline *is the buildings and structures of the surface complex - mine shafts, industrial, administrative, energy, transport and storage buildings, as well as surface structures of subways.*

Program learning outcomes:

knowledge:

– types and classification of buildings and structures of mining enterprises;

- volume-planning decisions of the mine surface;

– principles of construction of the general plan of the surface of mining enterprises;

– technological complexes and constructive solutions of the main and auxiliary trunks;

– constructive solutions of dills;

- complexes of enrichment factories;

- construction of energy facilities;

- construction of transport facilities;

– construction and operation of bunkers and silos;

– design and construction of the surface complex of subways;

skill:

- evaluate the technological and transport basis of the general plan of the surface of mining enterprises;

- characterize the structural types and functions of the technological complexes of the main and auxiliary trunks;

- justify effective constructive solutions and installation technologies of buildings and structures of the surface complex;

- justify the methods of construction and operation of energy and transport facilities;

- justify the effective structural parameters of the surface complex of subways;

– choose material and energy-saving construction technologies;

- evaluate the economic parameters of the construction of surface facilities of mining enterprises;

experience:

– a systemic vision of the interrelationships of the technological complex and volume-planning solutions of the surface of mining enterprises;

– assessment of the effectiveness of the general plan of the mine surface;

- substantiation of methods of design and construction of buildings and structures of the surface complex;

- generalization and analysis of volume-planning decisions of surface structures of the metro;

- comparative assessment of construction technologies and technical and economic indicators of construction.

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

The discipline is related to the basic special subjects of the specialty 184. Mining, in particular the construction cycle, and requires students to be prepared in natural and technical sciences at the bachelor's level. Its study uses the knowledge and skills acquired in the disciplines "Materials Science and Basics of Construction", "Building Materials and Structures of Underground Structures", "Engineering Geology", "Construction Mechanics", "Geoengineering of the Metropolis", etc. The theoretical knowledge and practical skills obtained in the course of studying the discipline must be used when preparing a master's thesis.

3. Content of the academic discipline

Topic 1. Volumetric planning solutions of the surface of mining enterprises
Topic 2. General plan of the surface of mining enterprises
Topic 3. Technological complex of the main and auxiliary trunks
Topic 4. Over-mine copra
Topic 5. Transport galleries and overpasses
Topic 6. Bunkers and silos
Topic 7. Complex of the beneficiation factory
Topic 8. Buildings and structures for energy purposes
Topic 9. Compositions
Topic 10. Buildings of administrative and auxiliary purpose
Topic 11. Surface complex of subway buildings
Topic 12. Design and construction of mining buildings and structures in special conditions.

4. Educational materials and resources

Recommended Books

Basic

1. *Ruwan Rajapakse.* **Geotechnical Engineering Calculations and Rules of Thumb.** *2nd Edition - November 18, Language: English, Published: November 18, Copyright: © Butterworth-Heinemann 2015. Imprint: Butterworth-Heinemann. p. 508.*
2. **Chandrakant S. Desai, Musharraf Zaman. Advanced Geotechnical Engineering Soil-Structure Interaction using Computer and Material Models. CRC Press, - 2013. 638 p.**
3. *Pijush Samui, Sunita Kumari, Vladimir Makarov, Pradeep Kurup* **Modeling in Geotechnical Engineering.** *1st Edition – Language: English. Copyright: Academic Press, 2020, p. 516.*
4. **Manuel Matos Fernandes. Analysis and Design of Geotechnical Structures, Uitgeveri j:Taylor & Francis LTD,** *English,* **2020, p. 732.**
5. *Shuren Wang, Paul Hagan, Chen Cao* **. Advances in Rock-Support and Geotechnical Engineering** *1st Edition - August 16, 2016. English. Copyright: © Butterworth-Heinemann. Imprint: Butterworth-Heinemann. –p. 422.*
6. *R Goel, Bhawani Singh, Jian Zhao.* **Underground Infrastructures** *Planning, Design, and Construction. 1st Edition - May 7, 2012. Language: English. - Butterworth-Heinemann. p.352.*

Additional literature

7. *Advanced Geotechnical and Structural Engineering in the Design and Performance of Sustainable Civil Infrastructures. Proceedings of the 6th GeoChina International Conference on Civil & Transportation Infrastructures: From Engineering to Smart & Green Life Cycle Solutions -- Nanchang, China, 2021.*
8. *Conference proceedings* **. Geotechnical Engineering and Sustainable Construction. . Editors Mahdi O. Karkush, Deepankar Choudhury.** *2022. PublisherSpringer Singapore. p. 816. DOI* *https://doi.org/10.1007/978-981-16-6277-5.*

Literature, the bibliography of which is given by link, can be found on the Internet.
Certain sections of the basic literature [1]-[6] are mandatory for reading. A section of basic literature that is required to be read, as well as the connection of these resources to specific topics of the discipline,

is given below, in the methodology of mastering the academic discipline. All other literary sources are optional, read them.

Educational conten

5. Methods of mastering an educational discipline (educational component)

Lectures:

Lecture 1. Volumetric planning solutions of the surface of mining enterprises

Subject and its structure. The surface complex of the mining enterprise. Classification of buildings and structures of the industrial site of the mine. Groups A and B, composition principles. The principle of ecological zoning. Spatial and planning decisions. [1, 2, 4].

Lecture 2. General surface plan of mining enterprises

The essence of the General Plan. The technological basis of the construction of the General Plan. The main nodes of the technological complex. Basic principles of the construction of the General Plan. Unified decisions of General Plans. Land transport and engineering networks [1, 2, 6].

Lecture 3. Technological complex of the main and auxiliary trunks

The principle of blocking buildings and structures. Complexes of buildings and structures on the mine surface. a complex of main and auxiliary trunks. Buildings of lifting machines and fan installations [1, 2, 3, 5, 6].

Lectures 4, 5. Overhead copra

General information about copra. Design solutions of metal copra. The main provisions of the calculation of metal copra. Design solutions of tower copra. Peculiarities of design and construction of tower pits. Design solutions and calculation of tunnels [1, 2, 4, 5, 6].

Lecture 6. Transport galleries and overpasses

Crane and unloading trestles. Transport and communication galleries. Spanning supporting structures of galleries (farms). Flat and spatial supports of galleries and their foundations. Typical designs of galleries. New structural types, materials and methods of gallery construction

[1, 2, 4, 5, 6].

Lecture 7, 8. Bunkers and silos

Classification of bunkers. Behavior of bulk material during release from the hopper. Bulk-planning decisions of bunkers. Design solutions of bunkers. Basic provisions for the calculation of bunkers. Silos. Features of construction and operation [1, 2, 4, 5].

Lecture 9. Complex of the enrichment factory

Types of enrichment factories and their functions. Technological processes of coal enrichment. Crushing and sorting department. Main body. Filtering and pressing department. Drying cases. Sumps and sludge collectors. Briquette factories. Environmental problems of enrichment factories [1, 2, 4, 5].

Lecture 10. Energy buildings and structures

Boiler rooms, their types and main elements. Smoke pipes. Volumetric and planning decisions of power substation buildings. Open distribution systems. Fan, heater and compressor buildings (types, structural solutions, construction methods) [1, 2, 4].

***Lecture 11**. Warehouses and workshops*

Buildings of warehouses of mining equipment and fastening structures. Yard. Open coal warehouse. Warehouse "on wheels" (wagon warehouse). Buildings of repair shops [1, 2, 3, 4, 5, 6].

Lecture 12. Buildings of administrative and auxiliary purpose

Administrative and household plant (APB), its blocks and premises. Volumetric and planning decisions of APB. Constructive solutions. Unified schemes. A modern approach to administrative and auxiliary buildings [1, 2, 4].

Lecture 13. Surface complex of subway buildings

Ground stations. Ground lobbies. Wagon depot. Ground traction substations. Surface mining complexes during the construction of subway tunnels [1, 2, 3].

Lecture 14. Construction of mining buildings and structures in special conditions

Peculiarities of the construction of mining buildings and structures in seismic areas and in areas where permafrost spreads. Peculiarities of construction on macroporous and alluvial soils and on artificial sites [1, 2, 3, 5, 6].

Practical training*:*

№ з/п	*Name of the subject of the lesson and list of main questions (a list of didactic support, references to the literature and assignments for the self study)*
1	*Determine the calculated loads applied to the nodes of the trusses of the span building of the conveyor gallery of the IS-O1-15 series*
2	*Determine the forces in the rods of the facade and wind farms of the IS-O1-15 series conveyor gallery. Accept standard sizes of structures*
3	*Determine the forces in the vertical elements of the flat support of the conveyor gallery (according to the calculated loads from work No. 1*
4	*Choose the type and calculate the foundation for the flat support of the conveyor gallery (according to the calculated loads from work #1)*
5	*Calculate the parameters of the metal bunker*

6. Self study of a student/graduate student

The student's independent work involves:

preparation for classroom classes - 10 p.m.;

preparation for modular control work – 4 hours;

execution of calculation work - 10 hours;

exam preparation – 30 hours

For correspondence students, independent work involves:

lesson preparation – 58 hours;

preparation for the modular control work - 4 hours;

execution of calculation work - 10 hours;

exam preparation – 30 hours.

The name of the topic, for independent study

Calculation and graphic work: Design of the conveyor gallery of the surface complex of the coal mine. After the work is done, protection is provided CGW.

№ з/п	*The name of the topic submitted for independent processing*
1	*Assessment of the degree of use of the territory of the General Plan [1, 2, 6].*
2	*Conveyor transport on the industrial site of mining enterprises [1, 2, 3, 5].*
3	*Economic analysis of types of mine pits [1, 2, 4, 6].*

4	*New materials and structures of bunkers [1, 2, 4, 5].*
5	*Construction technologies for the construction of smoke pipes [1, 2, 4].*
6	*Unification and typification in the construction of mining buildings and structures [1, 2, 5, 6].*
7	*Cogeneration energy complexes of a coal mine [1, 2, 4].*
8	*New approaches to construction in seismically dangerous areas [1, 2, 3, 5, 6].*
9	*Modern subway construction technologies in Ukraine [1, 2, 3].*

Policy and control

7. Politics, 3 classes are mandatory (in case of absence for a good reason - you must make an outline of the missed lecture*)*

• *educational activity, prior knowledge of lecture questions, use of communication tools to search for information on the Internet, and dialogic forms of communication are welcome in classes.*

• *rules for the defense of an individual assignment: the deadline is two weeks before the end of the academic semester, the defense of an individual assignment takes place in the form of an interview;*

• *in the case of missing classes without valid reasons, an essay on the topic of the missed lecture is written on 10-12 pages);*

• *at the end of the semester, an additional opportunity to submit/resubmit benchmarks is provided;*

• *policy on academic integrity - borrowing materials without references to author's works is not allowed, attempts at plagiarism (passing off other people's achievements as one's own) make admission to the control event impossible.*

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

1. A student's credit module rating is calculated out of 100 points. The starting rating (during the semester) consists of points that the student receives for:

– writing MKR in a practical session (modular work consists of 2 questions - 20 points);

– performance and defense of practical works (5 works = 30 points);

– implementation and protection of calculation and graphic work (10 points);

2. Scoring criteria:

– 2.1. Modular control work (maximum number of points - 20 points):

- *"excellent" - complete answer (at least 90% of the required information) - 17.5-20 points;*
- *"good" - sufficiently complete answer with minor inaccuracies (at least 75% of the required information) - 13-17.0 points;*
- *"satisfactory" - incomplete answer (at least 60% of the required information) - 9-12.5 points;*
- *"unsatisfactory" - unsatisfactory answer (less than 60%) - <9 points.*

2.2. Implementation and protection of practical works:

- *performance of practical work - 6 points (6 points are awarded for high-quality work, 2 points for poor performance):*
- *"excellent" - a complete answer (at least 90% of the required information), relevant justifications and a personal opinion are provided - 6 points;*
- *"good" - a sufficiently complete answer (at least 75% of the required information), which is completed in accordance with the requirements for the "skills" level or contains minor inaccuracies - 5 points;*

- *"satisfactory" - an incomplete answer (at least 60% of the required information), completed in accordance with the requirements for the "stereotypical" level and containing some errors - 3 points;*
- *"unsatisfactory" - unsatisfactory answer - 0 points.*

2.3. Execution and protection of calculation and graphic work (maximum number of points – 10 points):

- performance - a maximum of 10 points (9-10 points (90-100) are awarded for excellent work performance, 7.5-8.5 points (75-90%) for good performance, 6-7 points for satisfactory performance (60-75%), for unsatisfactory <6 points (<60%)),

***Calendar control:** is conducted 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 possible rating at the time of the corresponding calendar control.*

***Semester control:** exam. Conditions for admission to the semester control: completed and credited practical work, MKR and RGR.*

The exam paper is valued at 40 points. The control task of this paper consists of four theoretical questions from the list provided in the appendix to the syllabus.

Each question is evaluated out of 10 points according to the following criteria:

- *"excellent" - a complete answer (at least 90% of the required information), relevant justifications and a personal opinion are provided - 8-10 points;*
- *"good" - a sufficiently complete answer (at least 75% of the required information), completed in accordance with the requirements for the "skills" level or containing minor inaccuracies - 6-7 points;*
- *"satisfactory" - an incomplete answer (at least 60% of the required information), completed in accordance with the requirements for the "stereotypical" level and containing some errors - 4-5 points;*
- *"unsatisfactory" - unsatisfactory answer - 0 points.*

For correspondence education

***Current control:** The structure of Module test and CGW, requirements for them and evaluation criteria are similar to those for full-time education and are listed above.*

The sum of the starting points is transferred to the final grade according to the table.

The exam paper is valued at 40 points, as for full-time education. The evaluation criteria are given above.

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

Number of points	*Evaluation*
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*

Working program of the academic discipline (syllabus):

Compiled by an associate professor of the Department of Geoengineering, Ph.D. Zhukova N.I.

Approved by the Department of _____ (protocol No. ___ from _____)

Agreed by the Methodical Commission of the faculty (protocol No. __ from _____)

Addition

Control questions for exam preparation

1. Describe the surface complex of the mining enterprise.

2. Classification of buildings and structures of the industrial site of the mine. Groups A and B, composition principles.

3. The principle of ecological zoning of a mining enterprise.

4. Define and characterize the general plan of the surface of mining enterprises

5. The technological basis of the construction of the General Plan.

6. List the main nodes of the technological complex.

7. Basic principles of the construction of the General Plan.

8. Unified decisions of General Plans.

9. Describe ground transport and engineering networks.

10. Technological complex of the main and auxiliary trunks

11. The principle of blocking buildings and structures.

12. Complexes of buildings and structures on the mine surface. a complex of main and auxiliary trunks.

13. Describe the buildings of lifting machines and fan installations.

14. Overhead pits

15. Structural solutions of metal copra.

16. State the basic provisions for calculating metal copra.

17. Design solutions of tower spires.

18. Peculiarities of design and construction of tower dikes.

19. Design decisions and calculation of tunnels.

20. Describe transport galleries and overpasses.

21. Specify and describe crane and unloading trestles.

22. Transport and communication galleries.

23. Spanning supporting structures of galleries (farms).

24. Describe the flat and spatial supports of galleries and their foundations.

25. Name and describe typical designs of galleries.

26. Name and describe new construction types, materials and methods construction of galleries

27. Bunkers and silos. Specify the classification of bunkers.

28. Describe the behavior of bulk material during release from the hopper.

29. Bulk-planning decisions of bunkers.

30. Give constructive solutions of bunkers.

31. Give the main provisions for the calculation of bunkers.

32. Silos. Features of construction and operation.

33. Name and describe the enrichment factory complex.

34. Types of enrichment factories and their functions.

35. Identify and characterize the technological processes of coal enrichment.

36. Crushing and sorting department, its composition, purpose, equipment.

37. Sumps and sludge collectors.

38. Briquette factories.

39. Describe the environmental problems of enrichment factories.

40. Buildings and structures for energy purposes

41. Boiler rooms, their types and main elements. Smoke pipes.

42. Volumetric planning decisions of power substation buildings.

43. Fan, heater and compressor buildings (types, structural solutions, construction methods).

44. Describe warehouses and workshops.

45. Describe the buildings of warehouses of mining equipment and fastening structures.

46. Buildings of administrative and auxiliary purpose.

47. Administrative and household plant (APB), its blocks and premises. Volumetric and planning decisions of APB. Constructive solutions.

48. Modern approach to administrative and auxiliary buildings

49. Surface complex of subway buildings

50. Ground stations. Ground lobbies. Wagon depot. Ground traction.

51. Construction of mining buildings and structures under special conditions.

52. Features of the construction of mining buildings and structures in seismic areas.

53. Peculiarities of construction on macroporous and alluvial soils and on artificial soils

areas