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

Department of Geoengineering

SCIENTIFIC METHODS OF CONTROL OF GEOBUILDING AND MINING PROCESSES

Work program of the discipline (Syllabus)

Details of the discipline

Level of higher education	***Third (educational and scientific)***
Branch of knowledge	*18 Production and technology*
Specialty	*184 Mining*
Educational program	*Geoengineering*
Discipline status	*Selective*
Form of study	*full-time / full-time / distance / mixed*
Year of preparation, semester	*2nd year, spring semester*
The scope of discipline	*5 credits / 150 hours (lectures - 9 hours, practical - 5 hours, individual lessons - 40 hours, independent work - 96 hours)*
Semester control / control measures	*Credit, modular test*
Timetable	rozklad.kpi.ua/
Language of instruction	*Ukrainian*
Information about course leader / teachers	Lecturer: *Prof., Zuievska Natalia Valerievna, (+38) 0509821770, zuevska@i.ua* Practical:*Prof., Zuievska Natalia Valerievna, (+38) 0509821770, zuevska@i.ua*
Course placement	

Curriculum of the discipline

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

The purpose of teaching The discipline "Scientific methods of control of geoconstruction and mining" is to provide students with theoretical knowledge that allows them to independently, based on a correct assessment of engineering and geological conditions of the construction site to predict changes in stress-strain state of the array in the process of geotechnical work. violation of the surrounding structures in a dense urban development.

The subject study of the discipline are methods of predicting the behavior of soils in the construction of geotechnical objects in these soils.

Program competencies: ability to identify, pose and solve research problems in the field of mining, evaluate and ensure the quality of research.

Program results training: to develop and research conceptual, mathematical and computer models of processes and systems, to use them effectively for acquisition of new knowledge and / or creation of innovative products in geoengineering;

to apply modern tools and technologies of search, processing and analysis of information, information systems of geomonitoring and research of properties of arrays

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

Prerequisites: Geomechanical processes in rock massifs, Mathematical modeling of geomechanical processes

Postrequisites: formation of additional competencies about modern tools and technologies of search, processing and analysis of information, information systems of geomonitoring.

3. The content of the discipline

Section 1. Modern design tools in complex conditions

Section 2. Basics of methods for predicting maximum subsidence and slopes, as well as time parameters of surface displacement

Section 3. Modeling of the stress-strain state

soil massif, which contains a long-term mining in the software package Ansys

4. Training materials and resources

Basic literature:

1. Regularities of development of maximum sediments and surface slopes in the shear mold: Monograph // Nazarenko VO, Yoshchenko NV - D .: National Mining University, 2011. - 91 p. https://core.ac.uk/download/pdf/48403477.pdf

2. A finite element approach to solve contact problems ingeotechnical engineering // Jianqiang Mao / INTERNATIONAL JOURNAL FOR NUMERICAL AND ANALYTICAL METHODS IN GEOMECHANICS Int. J. Numer. Anal. Meth. Geomech., 2005; 29:525 –550 https://www.researchgate.net/publication/260259106_A_finite_element_approach_to_solve_contact_problems_in_geotechnical_engineering

2. Finite element analysis in geotechnical engineering Theory//David M. Potts and Lidija Zdravkovic Published by Thomas Telford Publishing, Thomas Telford Ltd, 1 Heron Quay, London URL: http://www.t-telford.co.uk

2. DBN B.2.1-10: 2018 Foundations and foundations of buildings and structures. Ministry of Regional Development of Ukraine, 2018. - 36 p. - (State building norms of Ukraine).

Additional literature:

1. DBN A.2.1-1-2008 Engineering surveys for construction
2. DBN B.1.1-24: 2009 Protection against dangerous geological processes. Basic design provisions
3. DBN B.1.1-45: 2017 Buildings and structures in complex engineering and geological conditions
4. DSTU-N B B.1.1-42: 2016 Guidelines for the design of buildings and structures in counterfeit areas
5. DSTU-N B B.1.1-44: 2016 Guidelines for the design of buildings and structures on subsiding soils
6. Kasyan NN Modeling of structurally inhomogeneous rock massifs using the finite element method / NN Kasyan, IG Sakhno, S.G. Negrei / Scientific Bulletin of the National Mining University. - 2008. - №5. - P. 49-52.

URI: http://ea.donntu.edu.ua/handle/123456789/4699

Educational content

5. Methods of mastering the discipline (educational component)

Names of lecture topics and a list of main issues
Section 1. Modern design tools in complex conditions
Features of design in difficult conditions. Dangerous natural and man-made processes. Design principles, groups of limit states. Types of buildings and types of deformation; reasons for the development of uneven deformation. Joint work of soils, foundations and structures. Sensitivity of buildings to uneven subsidence. Existing and used in practice software. Modern exogenous geological processes and phenomena. Influence of tectonic structures and fractures of rocks on engineering-geological conditions. Design automation. The concept of numerical methods for solving geotechnical problems. Features of development of geological processes under the influence of technogenic factors.
Section 2. Basics of methods for predicting maximum subsidence and slopes, as well as time parameters of surface displacement
Calculations of structures of buildings and structures in forged areas are recommended to be performed using observations and modern computer software that can predict the deformation of the soil mass and take into

account the interaction of the structure, its foundation structure and deformable base. There are a number of ways to predict the displacements and deformations of the massif and the earth's surface, based on the provisions of the mechanics of a continuous or discrete medium; physical analogies; analytical-empirical using various theories and functions, empirical and others. Timely and correct choice of measures to protect buildings and structures of the earth's surface during their forgery is determined by forecasting changes. Therefore, increasing the reliability of predicting deformations of the earth's surface is one of the most pressing scientific and practical tasks.

Mathematical modeling, implemented using analytical and numerical methods, is one of the main modern tools to investigate the stress-strain state of the rock mass in solving various problems of geomechanics, which allows to obtain qualitative characteristics and quantitative dependences. Numerous modeling methods have recently been widely used in geomechanics: the finite element method, the finite difference method, the boundary element method, the discrete element method, and combined methods.

Section 3. Modeling of the stress-strain state
soil massif, which contains a long-term mining in the software package Ansys

One of the main research methods in mining geomechanics is mathematical modeling. Intensive development of computer technology recently contributed to the development of numerical modeling methods and their superiority over analytical ones. The prospects of the finite element method for modeling geomechanical processes are recognized. This method is widely tested in the calculation of structures in different
engineering tasks. The main feature of the problems of mining geomechanics is their nonlinearity, which complicates the calculation procedure.

The name of the topic of practical classes and a list of key issues

Fundamentals of the method of forecasting the maximum vertical displacements and deformations of the earth's surface at the stage of formation of the displacement trough.

What are the numerous modeling methods used recently in geomechanics.

6. Independent work of a student / graduate student

The name of the topic for self-study

The choice of measures to protect buildings and structures of the earth's surface in their forgery is determined by the prediction of changes.

Influence of tectonic structures and fractures of rocks on engineering-geological conditions.

Modern exogenous geological processes and phenomena.

Policy and control

7. Course policy (educational component)

The system of requirements for students:

- attending lectures and practical classes is a mandatory component of studying the material
- at the lecture the teacher uses his own presentation material; uses Google Class to teach current lecture material, additional resources, labs, and more; Teacher gives you access to a specific Google Class directory to download electronic lab reports and MCR responses
- modular tests are written in lectures without the use of aids (mobile phones, tablets, etc.); the result is sent in a file to the appropriate Google Class directory
- incentive points are awarded for: active participation in lectures ;, preparation of reviews of scientific papers; presentations on one of the topics of the VTS discipline, etc. Number of encouraged points by more than 10
- penalty points are set for: late delivery of laboratory work. The number of penalty points is not more than 10

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

Current control is carried out in the form of two modular tests (assessment of each 12-25 points), 5 practical works (assessment of each 4-7 points), individual work (8-15).

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, the student performs a test. In this case, the sum of points for the performance of DCR and credit test is transferred to the final grade according to the table.

A student who received more than 60 points in the semester can take part in the test. In this case, the points obtained by him on the test are final.

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

Work program of the discipline (syllabus):

Folded Professor of the Department of Geoengineering, Doctor of Technical Sciences, Zuevskaya NV

Approved department _____ (protocol № ___ from _____)

Agreed IEE Methodical Commission (protocol № __ from _____)