National Technical University of Ukraine Kyiv Polytechnic Institute named after Igor Sikorsky

Department of Geoengineering

Logistics of transportation and transport systems

Work program of the discipline (Syllabus)

Requisites of primary discipline	
Level of higher education	***Second (master's)***
Field of knowledge	*18 Production and technology*
Specialty	*184 Mining*
Educational program	*Geoengineering*
Discipline status	*Selective*
Form of study	*Daytime*
Рік підготовки, семестр	*5 Year of preparation, semester*
Scope of discipline	*4(120)*
Semester control / control tests	*Test / Modular control test / Settlement and graphic work*
Timetable of classes	*According to the official schedule on the website http://rozklad.kpi.ua*
Teaching language	*Ukrainian*
Course leader/lecturer information	*Lecturer: assistant professor, Sergienko Mykola Ivanovich, ux0un@ukr.net* *Practical: assistant professor, Sergienko Mykola Ivanovich, ux0un@ukr.net*
Course placement	*Becomes available in Google Classroom before the start of the semester. The link to the course is provided by the instructor.*

Academic discipline program

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

Technological processes of cargo logistics and resource and energy saving, logistics of mining and transport systems, new highly efficient means of movement based on the latest foreign achievements of the leading mining countries of the world. Prospects and development of new industrial and transport systems. Modern transport systems, types and types of transport and their intensification of development require rational technical, economic and environmental use with mandatory consideration of the impact on the environment.

During the semester, students will study and choose directions to ensure high performance of the logistics of mining enterprises using modern transport systems and means of movement for specific operating conditions and types of cargo, analyze the technological processes of the transport system and determine the level of efficiency of resource and energy saving of the transport system, qualitative and quantitative assessment of the impact on refinement with the help of robotic transport systems and through reassignment.

The purpose of the discipline "Logistics of mining and transport systems" is to form in students a set of theoretical knowledge and practical skills to independently solve problems to improve the efficiency of logistics transport systems.

The subject of the discipline. Analysis and selection of optimal logistics schemes. Mastering the issues of the credit module contributes to the creation of rational logistics schemes of mining and transport systems.

According to the requirements of the curriculum, students after mastering the credit module must demonstrate learning outcomes:

Competence:

- К3. Ability to develop and implement rational quarry mining schemes;
- К4. Ability to justify ways and solutions to ensure high efficiency modern mining and transport systems, taking into account the environmental safety of their impact on the environment.

Skills:

- РН3. Be able to determine the main indicators of the transport system, qualitative and quantitative assessment impact on the efficiency of cargo movement;
- РН4. Determine the level of influence of mining and transport systems on the main technical economic and environmental performance of the enterprise.

2. Prerequisites and postrequisites of the discipline (place in the structural and logical scheme of training in the corresponding educational program)

Logistics of mining and transport systems is a technical discipline of the main industry of Ukraine, which is constantly evolving based on the latest achievements of science and technology, taking into account the impact on the environment. Therefore, the study of the discipline "Logistics of mining and transport systems" is based on a combination of knowledge gained by students in the study of disciplines of natural science and engineering and technology. The discipline "Logistics of mining and transport systems" is a fundamental basis that ensures the assimilation by students of the theory and fundamentals of cargo logistics, technologies and promising transport vehicles, both theoretical and practical, based on environmental protection and further implementation of the concept of sustainable balanced development of society and human well-being.

3. The content of the discipline

Introduction

***Section 1*. Logistics of mining transport systems**

Theme1. Logistics of mining transport systems and facilities of mining enterprises.

Theme 2. Technological transport of enterprises. Systematization of means of moving goods.

Theme 3. Fundamentals of the theory of cargo movement. Reliability and performance of transport vehicles.

Theme 4. Drive of transport vehicles.

***Section 2.* Logistics of continuous transport vehicles.**

Theme 5. Scraper conveyors

Theme 6. Belt conveyors.

***Section 3*. Logistics of transport machines of cyclic action**

Theme 8. Logistics of auto transport

Theme 9. Logistics of locomotive transport.

Theme 10. The mining-transport loaders

***Section 4*. Logistics of the latest technologies and transport vehicles**

Theme 11. Experience and prospects for the use of electric vehicles in the quarries of the world and Ukraine.

Theme 12. Prospects for the use of modern modes of transport

Theme 13. Utilization and processing of components and parts of vehicles.

Theme 14. Main directions of development of infrastructure logistics for underground facilities

4. Learning materials and resources

Basic literature

1. Contemporari mining logistic. Daniel L. Wardlow, Donald. F. Wood, James C. Jonson, Paul R,Murphy, jr. Publisher : Prentice Hall; 7th edition 2019, Language : English, Hardcover: 586 pages. ISBN-10 : 0137985487
2. Abrahamsson L, Johansson J (2006) From grounded skills to sky qualifcations: a study of workers creating and recreating qualifcations, identity and gender at an underground iron ore mine in Sweden. J Ind Relat 48:657–676. https://doi.org/10.1177/00221 85606070110
3. Transport complexes of quarries: textbook. allowance. Jim Smith, Edinbourg, UK. 2015. 241p.
4. The Mining Engineering Handbook (New Directions Engineering) | by W.F. Chen, J.Y. Richard Liew, et al. London, 2012
5. Albanese T, McGagh J (2018) Future trends in mining. In: Darling P (ed) SME Mining engineering handbook. Society for mining, metallurgy, and exploration, Englewood, pp 21–36

Additional

6. Bartos P.J. (2017) Is mining a high-tech industry: Investigations into innovation and productivity advance. Resour Policy 32:149–158. https://doi.org/10.1016/j.resourpol.2007.07.001
7. Bellamy D, Pravica L (2011) Assessing the impact of driverless haul trucks in Australian surface mining. Resour Policy 36:149–158. https://doi.org/10.1016/j.resourpol.2010.09.002
8. Horberry T, Burgess-Limerick R, Cooke T, Steiner L (2016) Improving mining equipment safety through human-centered design. Ergon Des: Quarter Human Factors App 24:1–6. https://doi.org/ 10.1177/1064804616636299
9. Horberry T, Lynas D (2019) Human interaction with automated mining equipment: the development of an emerging technologies database. ErgonAust 8:1–6
10. Johansson B, Johansson J (2018) 'The new attractive mine': 36 research areas for attractive workplaces in future deep metal mining. Int J Min Mineral Eng 5:350–361. https://doi.org/10.1504/IJMME.2014.066582
11. Lever P (2011) Automation and robotics. In: Darling P (ed) SME Mining engineering handbook, Third. Society for mining, metallurgy, and exploration, Englewood, CO, pp 805–827
12. Radomsky MC, Ramani RV, Flick JP (2021) Slips, trips & falls in construction & mining: causes & controls. Prof Saf 46:30–37
13. Randolph M (2019) Current trends in mining. In: Darling P (ed) SME Mining engineering handbook, Third. Society for mining, metallurgy, and exploration, pp 11–19
14. Reeves ER, Randolph RF, Yantek DS, Peterson JS (2019) Noise control in underground metal mining. The National Institute for Occupational Safety and Health, Pittsburgh
15. Diderichsen F., Andersson R. (2016) Technological development and technology in mining and its efect on the work environment mining industry. https://doi.org/10.1016/0022-4375(96)00014-X

Informational resources

1. Logistics solutions for the mining industry
   https://www.tibagroup.com/mining-logistics/
2. Ensure an efficient and safe mining transportation
   https://new.siemens.com/global/en/markets/mining-industry/transport.html
3. Different types of Mining Transportation
   https://steemit.com/science/@jonelq/different-types-of-mining-transportation
4. Mining transport solutions

https://www.volvotrucks.in/content/dam/volvo/volvo- trucks/markets/india/IndiaFiles/mining transport-solutions-br.pdf

5. Accurate weighing for mining transport
   https://blhnobel.com/solutions/mining-transport
6. International Movers of Mining and Construction Machinery
   https://freightplus.com/services/relocation-mining-machinery/

Literature, the bibliography of which is presented with reference, can be found on the Internet. Literature, the bibliography of which does not contain references, can be found in the library of the Igor Sikorsky Kyiv Polytechnic Institute. Igor Sikorsky

Educational content

5. Methodology for mastering the academic discipline (educational component)

When studying the material of the discipline "Logistics of mining and transport systems", the following methods of collective and individual creative active learning are used:
– generation of creative ideas, preparation of individual essays, photo presentations, participation in scientific conferences, methods of active creative learning, partly search tasks, reports and analysis of individual situations;
- if possible - conducting classes in the transport laboratories of the department of geoengineering, on existing samples, models, stands close to real operating conditions, watching videos on the latest logistics technologies and transport vehicles in the world, information and communication technologies that provide the problem-research nature of the learning process and activation of independent work of students, addition of training sessions with means of interaction based on network communication capabilities (using the Internet during distance learning).
- stimulation and encouragement in the classroom - additional points at lectures, practical classes, receiving prizes, diplomas, awards, at scientific conferences, seminars, exhibitions.

Lecture classes

Lectures on the discipline "Logistics of mining and transport systems" are aimed at:
- providing modern theoretical and practical knowledge in the discipline and their implementation in practical actual situations and problems;
- educating students of professional and business qualities and developing their independent creative thinking;
- the use of methodological features of processing the material for its better understanding and perception;
- the use of visual elements for the perception of the material;
– explanation of all newly introduced terms and concepts;
- accessibility for perception by this audience;
– formation of the necessary motivation and interest in students to continue their education during independent work;
– involvement of students in the process of creative work together with the teacher, generation of ideas, participation in scientific conferences, preparation of scientific articles and abstracts, photo presentations.

Lecture 1
Section 1. Logistics of mining transport systems
Theme 1. Logistics of mining transport systems and facilities of mining enterprises.
Introduction. The purpose of transport at mining enterprises and their impact on the main indicators of the enterprise. Scope and conditions of application. The main indicators of the work of means of moving

goods. Technical, economic and ecological efficiency of transport systems logistics. Modern logistics schemes for the movement of goods. Basic concepts of resource saving transport vehicles. The impact of transport on the environment.

Lecture 2

Theme 2. Technological transport of enterprises. Systematization of means of moving goods.

Vehicle classification. Types and types of vehicles. requirements for vehicles. Systematization of means of moving goods. Transport machines of cyclic and continuous action. The main parameters of the means of moving goods and the features of their operation. Freight and traffic. Characteristics, basic and quantitative indicators.

Lecture 3

Theme 3. Fundamentals of the theory of cargo movement. Reliability and performance of transport vehicles. Factors and conditions affecting the performance of vehicles. Basic indicators and units of mass and volumetric productivity. Productivity of transport machines of continuous and cyclic action. Theoretical, technical and actual performance of the transport machine. Estimated performance. Machine Performance Calculation Method

Lecture 4

Theme 4. Drive transport vehicles.

Purpose, basic requirements, classification of occasions by type of energy. General, electrical and kinematic diagram of the drive. Types and types of drives. Structures, main units and design features. Traction force and drive torque. Drive power and its definition. Drives with hydraulic turbo couplings. Schemes of control and drive control. Safety precautions and the impact of the drive on the environment.

Section 2.

Lecture 5

Theme 5. Scraper conveyors. Purpose, scope and conditions of application. Classification, types, parameters, equipment, device. Logistic scheme. Designs and design features. Performance Calculation Methodology Rules for Technical Operation and Safety. Environmental impact.

Lecture 6

Theme 6. Belt conveyors.

Belt conveyors: purpose, conditions and scope. Classification, types, characteristics, principle of action. Designs and design features. Tape and rubber-cable conveyor belts. Transfer of traction force from the drive drum to the conveyor belt and ways to increase it. Method of selection, justification and calculation of the belt conveyor

Lecture 7.

Theme 7. Methods of selection, justification and calculation of the belt conveyor. Construction of tension diagrams, characteristics, modes of operation of the conveyor for specific mining-geological and mining-technical operating conditions and logistics of a mining enterprise.

Lecture 8

Section 3. Logistics of transport machines of cyclic action

Theme 8. Logistics of road transport/

Section 4. Logistics of the latest technologies and means of transport

Theme 11. Experience and prospects for the use of electric vehicles in the quarries of the world and Ukraine. Purpose, conditions and scope. Advantages and disadvantages. Classification, types, characteristics of modern electric vehicles. Designs, design and circuit features. Principal, electrical and kinematic diagrams of an electric vehicle. Batteries, charging stations and devices. Work productivity. Comparative efficiency with diesel and carbureted vehicles. Advantages and disadvantages. Prospects of application as logistics at mining enterprises of the world and Ukraine. The impact of electric transport on the environment.

Lecture 12

Theme 12. Prospects for the application of logistics of new modes of transport

Terms of use of electric, hydrogen and hybrid transport. Technical, economic, environmental conditions and scope. Advantages and disadvantages. Energy recovery. Designs and design features.

Kinematic scheme. Schemes of converters of types of energy. Vehicle charging system. The environmental impact of the latest modes of transport
Lecture 13
Theme 13. Recycling and recycling of vehicle parts
Improving the environmental efficiency of transport by recycling, recycling and secondary components obtained for use in various sectors of the economy. Development and improvement of the efficiency of utilization of galvanic batteries
Lecture 14
Theme 14. Main directions of development of infrastructure logistics for underground facilities
Development of underground transport infrastructure of cities. Metro and underground tunnels. Underground tunneling shields and transport vehicles for logistics and construction of underground transport tunnels, subways, special facilities.

TEST

Practical training

It is planned to conduct practical classes in the discipline "Logistics of mining and transport systems". Topics that allow a better understanding of the lecture material and gain additional practical knowledge on the design features of transport vehicles, learn how to perform the necessary calculations to determine the main parameters and modes of operation of logistics systems and means of transport, find out the impact of vehicles on the environment and maintenance personnel and assess potential environmental risks. The content of these classes and the methodology of their conduct contribute to the development of the creative activity of the student's personality. They develop scientific thinking and the ability to use special terminology, allow checking knowledge, and therefore this type of work is a fundamental means of operational feedback. Therefore, practical classes perform not only cognitive and educational functions, but are also designed to promote the growth of students as creative technical and environmental specialists.

Topics for practical classes and a list of key questions

Practical work 1. Logistics of mining transport systems
Practical work 2. Drives of transport machines
Practical work 3. Scraper Conveyors
Practical work 4. Calculation of a belt conveyor
Practical work 5. Calculation of road transport
Practical work 6. Logistics calculation using combined technological systems
Practical work 7. Locomotive transport
Practical work 8. Modular test.
Practical work 9. Electromobility
Practical work 10. Calculation of a front loader
Practical work 11. Justification and selection of a logistic scheme and a tunneling shield for underground transport tunnels

Practical lessons include: watching thematic videos on the latest achievements in logistics technologies and machines.

6. Independent work of the student

The main task of independent work of students is the mastery of scientific knowledge in the field of logistics of mining and transport systems that were not included in the list of lecture questions through a personal search for information, the formation of an active interest and a creative approach to educational work. Independent work of students also includes preparation for writing a modular test and preparation for the exam.

The name of the topic that is submitted for independent study	Number of hours of IJS
Logistics of mining transport systems and facilities of mining enterprises.	3
Technological transport companies. Systematization of means of moving goods.	4
Fundamentals of the theory of cargo logistics. Reliability and performance of transport vehicles.	5
Drive of transport vehicles.	5
Logistics of continuous transport vehicles	9
Logistics of transport machines of cyclic action	9
Loaders of cyclic action of mining and energy enterprises	7
Logistics of electric and hydrogen transport	9
The main directions for the development of infrastructure logistics for underground facilities	7
MKT	2
Exam preparation	6
Total hours on IJS (SRS)	66

Politics and control

7. Policy of the academic discipline (educational component)

The key measures in teaching the discipline are those that form the student's semester rating. Therefore, students must complete assignments in practical classes in a timely manner, write a test paper in the time allotted for this. There are no penalty points for the discipline. A student can receive incentive points for an in-depth study of individual topics of the course, which can be presented in the form of scientific abstracts, scientific articles, photo / video presentations, etc., as well as for active participation in discussions in practical and lecture classes.

Class attendance and behavior in class

Class attendance is free, points for attending lectures are not attached, penalty points for missing classes are not provided. However, a significant part of the student's rating is formed through active participation in activities in practical classes, namely in solving case problems, group and individual work. Therefore, skipping a certain practical lesson does not allow the student to get points for it in the semester rating.
In the classroom, the student is allowed to use interactive teaching aids, incl. access the Internet in order to search for training or reference information, if this is provided for by the subject of the task. The activity of the student in pairs, his readiness for discussions and participation in the discussion of educational issues can be assessed with incentive points at the discretion of the teacher.

Control measures missed

To test the degree of assimilation of theoretical material by students and the ability to use the acquired knowledge in solving practical problems, a test is provided.
If the control measures are missed for good reasons (illness or serious life circumstances), the student is given the opportunity to make an additional control task within the next week. Rewriting the test is not allowed. In case of violation of deadlines and failure to complete the task for disrespectful reasons, the student is not allowed to take the test in the main session.

Debt and rescheduling policy

In the event of arrears of discipline or any force majeure, students should contact the teacher through available (provided by the teacher) communication channels to resolve issues and agree on an algorithm for practice.

Policy of academic behavior and ethics

Students must be tolerant, respect the opinions of others, formulate objections in the correct form, constructively maintain feedback in class.

Norms of ethical behavior of students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Kyiv Polytechnic Institute named after Igor Sikorsky". Details: https://kpi.ua/code.

The policy of academic integrity is described in detail in the KPI Code of Honor. Igor Sikorsky.

This means that the student takes full responsibility for ensuring that all tasks performed by him comply with the principles of academic integrity.

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

Current control: test for the interviewed lecture (13 lectures × 3 points = 39 points, tasks within the practical lesson (13 practical lessons × 3 points = 39 points), MCR (conducted in a practical lesson, 22 points). Calendar control: conducted twice on semester as a monitoring of the current state of compliance with the requirements of the syllabus.The condition of a positive first calendar control is to obtain at least 33 points, the second calendar control - to obtain at least 60 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 test task of this work consists of two theoretical questions from the list provided in the appendix to the syllabus and a practical task.
- 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 practical task is evaluated in 24 points according to the following criteria:

- "excellent" - a complete answer (at least 90% of the required information), appropriate justifications and a personal opinion are provided - 24 - 22 points;
- "good" - a fairly complete answer (at least 75% of the required information), made in accordance with the requirements for the level of "skills" or containing minor inaccuracies - 21 - 18 points;
- "satisfactory" - an incomplete answer (at least 60% of the required information), made in accordance with the requirements for the "stereotypical" level and containing some errors - 17 - 15 points;
- "unsatisfactory" - unsatisfactory answer - 0 points.

Correspondence table of rating points to assessments on the university scale:

Number of points	*Grade*
100-95	Perfectly
94-85	Very good
84-75	Good
74-65	Satisfactorily
64-60	Enough
Less 60	Unsatisfactory
Admission conditions are not met	Not allowed

8. Additional information on the discipline (educational component)

Indicative list of topics submitted for semester control questions

1. Key concepts and definitions in the field of logistics for the movement of goods
2. Conditions and scope of technological schemes and logistics facilities
3. Types of vehicles of continuous operation. Their properties, conditions and scope of operation, the main characteristics and characteristics of work.
4. Kinds, types of vehicles of cyclic action. Characteristics, conditions and scope of operation; main indicators and parameters of work.
5. the main types of transport vehicles for specific conditions for the movement of goods.
6. Prospects and conditions for the use of electric vehicles at mining enterprises.
7. Pipeline transport. Application conditions. Advantages and disadvantages.
8. The purpose and objectives of studying the discipline "logistics of mining and transport systems"
9. Types of drives for transport vehicles. Purpose, scope, device.
10. Types and types of drives of transport vehicles by types of energy sources. Environmental impact.
11. Transport vehicles with internal combustion engines. Advantages and disadvantages.
12. Transport vehicles with hydrogen engines. Advantages and disadvantages. Environmental impact.
13. Transport vehicles with hydraulic drive. Advantages and disadvantages. Environmental impact.
14. Pneumatic transport. Scope and conditions of application. Advantages and disadvantages.
15. Productivity of transport vehicles. Mass and volume units of performance.
16. Reliability of transport machines of continuous and cyclic action
17. Scraper conveyors. Purpose, principle of action, structure. Environmental impact.
18. Belt conveyors. Purpose, principle of action, structure. Environmental impact.
19. Methodology and calculation of the belt conveyor.
20. Road transport. Appointment. Main characteristics and properties.
21. main directions and trends in the development of motor transport.
22. Locomotive transport for industrial and civil purposes. Application conditions. Device, basic systems. Contact and battery electric locomotives.
23. Locomotives. Application conditions. Device, basic systems. Environmental impact
24. Electric transport. Current state. Development prospects. Structure. Environmental impact.
25. Recycling, recycling of car batteries.
26. Hoisting and transport machines of mining industries. Kinds. Device, conditions of use.
27. Rope transport. Scope and conditions of application. Structure. Environmental impact.
28. Loaders. Application conditions. Advantages and disadvantages. Characteristics. Structure
29. Prospects for the development and implementation of the latest modes of transport.
30. Prospects for the use of renewable energy sources for transport vehicles.
31. The use of biofuels for the engines of transport vehicles.
32. Prospects, conditions for use in mining transport vehicles with hydrogen engines
33. Prospects and logistics for the development of electric vehicles.

34. The use of robotic electric vehicles in mining enterprises
35. Main directions of development of the latest modes of transport.
38. Calculation of auto transport in a mining enterprise.
39. Calculation of the performance of transport machines of continuous action. Initial data.
40. Selection and calculation of the technical performance of cyclic machines.

The working program of the academic discipline (syllabus):

Compiled by: Lecturer of the Department of Geoengineering, _____ Mykola SERGIENKO

Accepted: Department of Geoengineering (protocol No. ____ dated _____20)

Agreed by: IEE Methodological Commission (protocol No. ____ dated _____ 20)