MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
State Higher Education Institution "Pryazovskyi State Technical University"
Faculty of Transport Technologies
Department of Technology of International Transportation and Logistics

APPROVED:
Dean of the Faculty
of Transportation Technology
_____ N. Zakharenko

«____»_____ 2020

PROGRAM OF THE EDUCATIONAL DISCIPLINE

SIMULATION OF COMPLEX TRANSPORT PROCESSES AND SYSTEMS THAT OPERATE IN CONDITIONS OF RISKS
(code and name of the discipline)

To obtain an educational degree: Master's degree in transport technology

Specialty 275 «Transport Technologies (by species)»
(code and name of the specialty)

Specialization 275.03 «Transport Technologies (Automobile Transport)»
(code and name)

Educational Program «Crisis and risk engineering for transport services»
(name)


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DEVELOPER: A. Lyamzin, Candidate of Technical Sciences (PhD), Associate Professor

The working program was approved at a meeting of Department of Technology of International Transportation and Logistics

“10” 06 2020 year, protocol № 17

Head of Department _____ (A. Lyamzin)
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Approved by the methodological committee of the Faculty of Transport Technologies

“26” 06 2020 year, protocol № 11

Head of committee _____ (N. Zakharenko)
(signature)

Approved by the Scientific Council of the Higher Educational Institution "PSTU"

“02” 07 2020 year, protocol № 11

INTRODUCTION

Mode of study	ECTS credits	Hours	Classroom hours				Independent work	Semester distribution			
			Total	Lectures	Practical	Laboratory		Exams	Credits	Course works	Course projects
Full-time	5	150	48	32	16		102	10			

Curriculum Study Program "Simulation of complex transport processes and systems that operate in conditions of risks (SCTP)" compiled in accordance with the educational and professional training program for applicants secondary (master's) level of higher education in the specialty (specialization): specialty 275 «Transport Technologies (by species)»; specialization 275.03 «Transport Technologies (Automobile Transport)»; educational program «Crisis and risk engineering for transport services»

The subject of the course is the formation of students' professional theoretical and practical competencies in the field of decision-making in the transport environment, and their further optimization in the condition of the existing spectrum of risks and the crisis that they have formed.

Interdisciplinary Relations.

Previous disciplines: Trucking systems; System analysis.

Disciplines provided: Informational-analytic and diagnostics for sociotechnical system; New technologies and big data for innovations in crisis and risk management + IT Security.

The course program consists of the following content modules:

Content module 1.

Content module 2.

1. The goals and objectives of the discipline

1.1. The purpose of teaching the discipline of the: "Simulation of complex transport processes and systems that operate in conditions of risks" is to help students master a wide range of competencies, which include: using mathematical methods of forecasting, optimal planning and regulation, as well as analysis of transport processes and phenomena related to solving problems in the passenger and cargo service system.

1.2. The main tasks of studying the discipline of the: "Simulation of complex transport processes and systems that operate in conditions of risks" is:

– Mastering of methods for making effective technical and technological solution, as well as an understanding of modern crisis problems in the transport environment;
– Familiarization with key economic and mathematical mechanisms for optimizing decisions aimed at ensuring the efficiency of transport processes;
– Analyze the problems of determining optimal solutions in the field of transport services, and ensuring the efficiency of transport systems using the whole set of knowledge acquired in the study of this discipline;
– To use the acquired knowledge in their professional activity.

1.3. List of competencies: Ability to research and control automobile traffic vehicles; Ability to manage the reliability and efficiency of transport road transport technologies; Ability to determine performance indicators transport and to ensure the quality of work in the development and implementation of complex actions and projects in compliance with working conditions, provisions of civil protection and environmental protection; Development of scenarios for a clear, immediate action plan in the event of a risk situation for reducing, rectification of the consequences of disasters and restoring the work of the TS in the shortest possible time.

According to the requirements of the educational and professional program, students should:

know:

– Mechanisms for the formation of optimal decisions, taking into account multi-criteria, random and uncertain factors, exacerbate the intuition of the decision maker.
– Mechanisms of automation and optimization of decision-making processes and rational selection of technological solution in the efficiency management system of the components of transport systems
– Economic and mathematical methods as a peculiar way of knowing and managing processes and phenomena;
– Basic principles of analysis, construction and use of models to describe and predict processes in transport;
– applied software personal electronic computers (PC) in the field of mathematical modeling**.**

Be able to:

– Use modern mathematical methods used for forecasting, optimal planning and regulation, as well as analysis of specific processes and phenomena associated with the solution of transport problems.
– Make a modern analysis of the main questions related to the activities of transport systems.

The course takes 150 hours 5 of ECTS credits.

2. Information volume of the discipline

Content module 1.

Theme 1. Deterministic scalar optimization problems

The purpose of theme 1 is to give an idea of the history of the SCTP and the decision optimization process, typical mistake, axiomatics, to introduce the general task statement of individual and group decision-making, task classification and decision methods, and also help to master the methods of solving deterministic scalar optimization problems.

As a result of mastering theme 1, the student should be ready to demonstrate the following competencies and level of preparation:

- knowledge of the basic concepts of SCTP (general theoretical level)
- understanding of the decision-making process, individual tasks and methods and possession of measurement scales in the decision-making process (user level)
- skills of designing and programming of individual methods and components of the SCTP (researcher level).

The list of questions on theme 1:

1. Decision making process - decision making;
2. Tasks and methods of decision-making;
3. Scales and measurement methods in the decision-making process;
4. Decision making in nonlinear distribution tasks of transport systems;
5. Decision making in streamlining tasks.

Theme 2. Adoption of optimization decisions in the confrontation of the components of the transport environment

The purpose of theme 2 is to give an idea of the game approach to optimizing solutions in confrontational conditions, introduce fundamental concepts and results of game theory, and also help to master various methods of solving games.

As a result of mastering theme 2, the student should be ready to demonstrate the following competencies and level of preparation:

– knowledge of the main theorem of the theory of two-person antagonistic games with zero sum (general theoretical level);
– the ability to build the matrix of the game and knowledge of methods for analyzing the strategies of players (user level);
– skills for solving game tasks with exact and approximate methods (designer level).

The list of questions on theme 2:

1. History, tasks and types of games;
2. The main theorem of antagonistic games of two components of a transport environment with zero sum;
3. Geometric solution to games;
4. Solving games by the method of successive approximations;
5. Solving games by linear programming.
6. Methodology for optimization of logistics solutions.

Content module 2.

Theme 3. Making optimal decisions in the conditions of uncertainty of the components of the transport environment, neutrality and assistance

The purpose of theme 3 is to give an idea of approaches to the rational choice of solutions in conditions of uncertainty, neutrality and assistance, to introduce fundamental concepts and results of the theory of statistical games, and also to help master various methods of solving tasks of the theory of statistical games.

As a result of mastering theme 3, the student should be ready to demonstrate the following competencies and level of preparation:

– knowledge of the main types of uncertainty, statistical decision-making criteria in a game with nature (general theoretical level);
– the ability to make a choice on the basis of experiment and under favorable conditions (user level);
– skills of making statistical decisions in conditions of uncertainty, decision making in assignment tasks (designer level).

The list of questions on theme 3:

1. Statistical criteria and decisions in the game with nature;
2. Statistical criteria and decisions in a game with nature
3. Axioms of rational choice;
4. The choice on the basis of experiment, in conditions of assistance and fuzzy uncertainty;
5. Making decisions in the assignment task;

Theme 4. Multi-criteria tasks. Markov models. Group choice

The purpose of theme 4 is to provide an idea of approaches to solving multi-criteria optimization problems, introduce fundamental concepts of Pareto - optimal and Markov decision-making models, and also help to master various methods of making group decisions.

As a result of mastering theme 4, the student should be ready to demonstrate the following competencies and level of preparation:

– knowledge of statements of multi-criteria tasks, paradoxes and axioms of voting systems (general theoretical level);

– the ability to find Pareto-optimal solutions and apply Markov decision-making models (user level);
– skills of making strategic decisions by the method of hierarchy analysis (user level).

The list of questions on theme 4:

1. Multi-criteria tasks;
2. Pareto-optimal solutions;
3. Making decisions in planning tasks;
4. Markov models of decision making;
5. Paradoxes and axioms of the voting system.

TOPICS OF PRACTICAL WORK

Practical work 1. Solving combinatorial optimization problems – «The Knapsack Problem».
Practical work 2. Solution of elementary optimization problems in transport systems.
Practical work 3. Finding extremums of functions describing the dynamics of the transport process.
Practical work 4. Management of the optimal value of the stock in different organizational and methodological conditions.
Practical work 5. Experiment planning.
Practical work 6. Mathematical modeling.
Practical work 7. Physical model.
Practical work 8. Simulation modeling.

3. Recommended literature

1. Ларичев О. И. Теория и методы принятия решений, а также хроника событий в волшебных странах: Учебник. – М.: Логос, 2002.
2. Микони С. В. Теория и практика рационального выбора: Монография. – М.: Маршрут, 2004.
3. Петровский А. Б. Теория принятия решений: Учебник. – М.: Изд. центр «Академия», 2009.
4. Таха Х. А. Введение в исследование операций. – М.: Издательский дом «Вильямс», 2001.
5. Смоляков Э. Р. Теория конфликтных равновесий. М.: Едиториал УРСС, 2005.
6. Оуэн Г. Теория игр. – М.: Едиториал УРСС, 2007.
7. The site of the «International Journal of Game Theory» [internet resource], the journal page on the publishing site: http://www.springerlink.com/app/home/jou...;http://www.springeronline.com/sgw/cda/fr... «International Journal of Game Theory» is published by Physica Verlag and has been published quarterly since 1997. Editor-in-Chief William Thomson,

Professor of Economics, University of Rochester. The journal contains articles, reviews, research results, dedicated to game theory and methodology, and applications in various areas of decision theory and other sciences.
8. The site of the «International Game Theory Review» (IGTR) [internet resource] http://ejournals.wspc.com.sg/journals/ig... is published on a quarterly basis by World Scientific Publishing Co. Editor-in-Chief David W. K. Yeung. Game Theory Center, Professor Hong Kong Baptist University. The journal regularly publishes articles, reviews, research findings on game theory and methodology, as well as applications in various areas of decision theory and other sciences.

4. Form of final control of learning success

Semester (academic) control provides for the examination, during which the student is given a final grade for the discipline, which is ranked as the average of the results of the final module control and the result of rescheduling the grade for the discipline.

5. Means of diagnostics of success of training

Oral and written questioning, testing, current and module control work, defense of laboratory work, assessment of attendance and activity at lectures, practical and seminar classes, evaluation of independent work.