

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

APPROVED:
Dean of the Faculty
of Transportation Technology
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« ____ » _____ 2020

PROGRAM OF THE EDUCATIONAL DISCIPLINE

EMERGING TECHNOLOGIES AND BIG DATA FOR INNOVATION IN CRISIS
AND RISK MANAGEMENT + IT SECURITY
(code and name of the discipline)

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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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2020 year

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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)
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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 “Emerging technologies and big data for innovation in crisis and risk management + IT security (BD)” 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 entry requirements for the study of the subject "BD" is the presence of competencies formed at the previous level of education and directly related to the disciplines of the general professional cycle (probability theory and mathematical statistics, computer science). The knowledge gained as a result of mastering the discipline of BD will help in collecting and analyzing huge amounts of structured or unstructured information, developing data models and gaining new knowledge. All this is necessary for the graduate who has mastered the program of the magistracy, to solve various problems of practical and research activity. Tasks of mastering of a discipline: acquisition by students of knowledge about technologies of preparation, storage, processing and analysis of big data; application of statistical and mathematical methods for analysis of large volumes of information and others.

Interdisciplinary Relations.

Previous disciplines: Trucking systems; System analysis.

Disciplines provided: Informational-analytic and diagnostics for sociotechnical system; Simulation of complex transport processes and systems that operate in conditions of risks.

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: «is to help students master a wide range of competencies, including: using mathematical methods of forecasting, optimal planning and regulation, as well as analyzing transportation

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: “Emerging technologies and big data for innovation in crisis and risk management + IT security (BD)” is:

- to provide guidance in the most important IT sections as a basis for further study and further development and use of databases in a crisis;
- form an understanding of the technical and methodological tools of Big Data analysis;
- to achieve mastering of basic principles and concepts that allow to consciously apply this knowledge in practical activity taking into account a wide range of risks of the modern economic and social environment;
- use the skills of analyzing large amounts of data to solve a wide variety of tasks.

1.3. List of competencies: have the skills to use modern information and communication technologies to solve applied problems; must have the skills to apply modern software mechanisms to analyze, store and protect large amounts of information; have the skills to construct diagrams of different types with the derivation of mathematical equations characterizing the process under analysis with the formation of limits of adequacy of its functional; have the skills of intellectual analysis of the process in the context of the existing nature of the crisis; have the skills of SMART mechanisms for the formation of modern hypotheses for the development of the socio-economic nature of processes in modern realities.

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

know:

- Course terminology;
- Modern technologies of creation and maintenance of big data;
- Forecasting methodology and methodology;
- Basic concepts of Big Data technology;
- Basic concepts of forecasting;
- Basic forecasting technologies;

Be able to:

- Define Big Data arrays;
- Analyze big data clusters;
- To make forecasts of development of economic processes in different ways.

The course takes 150 hours 5 of ECTS credits.

2. Information volume of the discipline

Content module 1.

Theme 1. Introduction to Big Data

The purpose of theme 1 - Formation of skills to analyze socio-economic tasks and processes using methods of system analysis and mathematical modeling.

As a result of mastering topic 1, the student must have:

- terminology and basic methods of mathematical statistics;
- skills in applying statistical methods to processing and analyzing large amounts of information.

The list of questions on theme 1:

1. The history and causes of Big Data;
2. Big Data Features and Sources;
3. Four main types of data;
4. Data analytics;
5. Tasks that Big Data solves.

Theme 2. Data analytics lifecycle

The purpose of theme 2 - Formation of skills to solve standard tasks of professional activity on the basis of information and bibliographic culture using information and communication technologies and taking into account basic requirements of information security.

As a result of mastering the theme 2, the student must have the skills to use modern information and communication technologies to solve applied problems.

The list of questions on theme 2:

1. Business Intelligence (BI);
2. ETL (Extract, Transform, Load) - process;
3. BI tools;
4. Online Analytical Processing (OLAP);
5. BI Analysis Tools;
6. The concept of the life cycle of data analytics.

Theme 3. High-performance computing

Purpose of Theme 3 - Formation of the ability to develop, implement and adapt application software.

As a result of mastering topic 3, the student must have the skills to analyze and choose the best software for data analysis.

The list of questions on theme 3:

1. Hadoop and Map Reduce history;
2. Hadoop Distributed File System;
3. Map Reduce technology;
4. Hadoop architecture.

Theme 4. Scaling and multilevel storage

Purpose of theme 4 - Formation of skills of stages of introduction of the database and support of information support of the decision of applied problems.

As a result of mastering theme 4, the student must have the skills to apply modern software mechanisms to analyze, store and protect large amounts of information.

The list of questions on theme 4:

1. Scaling and multilevel storage;
2. NoSQL (Not Only SQL);
3. Scalability;
4. CAP theorem.
5. Mongo DB

Content module 2.

Theme 5. Data visualization and analysis results

The purpose of theme 5 - Formation of skills of stages of formation of graphical methods of analysis of statistical data and their mathematical analysis with its subsequent adjustment.

As a result of mastering the theme 5, the student must have the skills to construct diagrams of different types with the derivation of mathematical equations that characterize the process being analyzed with the formation of boundaries of adequacy of its functionality.

The list of questions on theme 5:

1. Types, tasks and types of visualization;
2. Graphs, charts, infographics;
3. Interactive stitling, dashboard;
4. Language R and its capabilities;
5. Amazon S3;

6. Data deduplication.

Theme 6. Formation of analytical skills for identifying patterns by means of intellectual analysis in the processes under study in the conditions of the existing spectrum of risk factors

Purpose of Theme 6 - As a result of mastering topic 6, the student must have the skills of intellectual analysis of the process in the context of the existing nature of the crisis.

The list of questions on theme 6:

1. Data Mining;
2. Intellectual analysis of data, its, differences and tasks;
3. Text Mining;
4. Web Mining;
5. Web Content Mining;
6. Web Usage Mining;
7. Social media mining;
8. Rapid Miner.

Theme 7. Statistical methods of data analysis

Purpose of Theme 7 - Formation of target model development skills aimed at forming adequate hypotheses for the development of processes in crisis and the criteria that characterize them.

As a result of mastering the theme 7, the student must have the skills of SMART mechanisms to form modern hypotheses for the development of socio-economic nature of processes in modern realities.

The list of questions on theme 7:

1. Statistical hypotheses and criteria;
2. Machine learning;
3. Metric and linear classifiers;
4. ROC - curve;
5. Cluster analysis.

TOPICS OF PRACTICAL WORK

Practical work 1. The current state of Big Data.

Practical work 2. Big Data programming model.

Practical work 3. Data types NOSQL.

Practical work 4. The architecture of the data warehouse.

Practical work 5. Document-oriented repository.

Practical work 6. Non-relational databases are partially agreed.

Practical work 7. Elements of the HADOOP cluster.

Practical work 8. Distributed programming frameworks.

Practical work 9. Creating indexes and using them in queries.

3. Recommended literature

1. Майер-Шенбергер В., Кукьер К. Большие данные. Революция, которая изменит то, как мы живем, работаем и мыслим. Language Arts & Disciplines – 2013. – 599с.

2. Силен Д., Мейсман А., Али М. Основы DataScience и BigData. Python и наука о данных. СПб: Питер. – 2017. – 336с.

3. Фаулер М., Прамодкумар Дж. Садаладж. NoSQL: новая методология разработки нереляционных баз данных. – М.: «Вильямс», 2013. – 192с.

4. Павлов В. М. Искусство решать сложные задачи. Системный подход. - М.: Издательско-торговая корпорация 'Дашков и К', 2014. - 184 с. // Режим доступа - онлайн: <http://znanium.com/bookread.php?book=450820>

5. Орлова В. И. Экономико-математическое моделирование: Практическое пособие по решению задач / И. В. Орлова. - 2-е изд., испр. и доп. - М.: Вузовский учебник: НИЦ Инфра-М, 2012. - 140 с.: 60 x 88 1/16. (обложка) ISBN

6. 978-5-9558-0107-0 // Режим доступа - онлайн: <http://znanium.com/catalog.php?bookinfo=359462>

7. Статистика: общая теория статистики, экономическая статистика. Практикум / Непомнящая Н. В., Григорьева Е. Г. - Краснояр.: СФУ, 2015. - 376 с.: ISBN 978-5-7638-3185-6 // Режим доступа - онлайн: <http://znanium.com/catalog.php?bookinfo=549841>

8. Теория вероятностей и математическая статистика: Учебное пособие / Бирюкова Л. Г., Бобрик Г. И., Матвеев В. И., - 2-е изд. - М.: НИЦ ИНФРА-М, 2017. - 289 с.: 60 x 90 1/16. - (Высшее образование: Бакалавриат) (Переплёт 7БЦ) ISBN 978-5-16-011793-5 // Режим доступа - онлайн: <http://znanium.com/catalog.php?bookinfo=370899>

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.