SYLLABUS "ECONOMIC AND MATHEMATICAL MODELS AND METHODS"

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Department responsible for the course or equivalent: Institute of Management in Economic, Ecological and Social Systems Management and Innovative Technologies Department

Semester when the course unit is delivered: 3rd

Level of course unit: Bachelor level

ECTS credits: 6

ADMISSION REQUIREMENTS

Applicants are expected to have completed the following courses:

- Economy;
- Mathematics.

COURSE OBJECTIVES (AIMS)

- to know the basic mathematical models of economic theory and decision-making practices;
- to know meaningful and mathematical statements of the problems of economics and business, solved by economic and mathematical methods;
- to know basic economic and mathematical methods;
- to know the methodology and methodic for constructing the analysis and use of economic and mathematical models, the basic algorithms for solving them and computational aspects;
- to know a methodology for constructing an econometric model based on qualitative and quantitative analysis of the object of study;
- to solve typical mathematical problems used in decision making;
- to compile, use and analyze economic and mathematical methods and models for the complex solution of economic and social problems;
- to plan, evaluate, develop and make effective decisions in a market economy;
- to apply econometric models in business practices: to predict the behavior of business entities on the basis of such models, assess the financial condition of the company and develop and make optimal management decisions;
- to apply methods of constructing economic and mathematical models to solve various optimization problems;

- to apply sufficient knowledge and skills to formulate the concept of an econometric model;
- to apply tools for constructing with subsequent quality assessment of econometric models of the studied economic phenomena, processes and objects.

COURSE CONTENTS

Session 1. Mathematical Methods of Budget Modeling.

• Budget as an Object of Modeling and Management. •Budget Models . • Mathematical Budget Models .

Session 2. Methods and Mathematical Models of Budget Management .

•Current Trends in Budgeting . •Current State of Budget Control Methods and Mathematical Models . •General Concept of the Programmable Method of Budget Mechanism Control . •Mathematical Models of Budget Expenditure . •Mathematical Models of Budget Revenue Part . •Model of Information System for Program Budget Control .

Session 3. Energy-Entropic Methods in Assessment and Control of Economic Systems .

•Arguments in Favor of Application of the Thermodynamic Approach to Economic Systems . • Energy-Entropy Model for Assessment of Economic System Management . • Energy-Entropy Approach as the Basis of System Estimation of Production Management Quality .

Session 4. Currency Trading Methods and Mathematical Models . • Currency Market Research and Management . • Mathematical Models of Equilibrium Exchange Rates . • Mathematical Projection Models for Currency Transactions . • Information Decision Support Systems in Currency Operations

Session 5. Methods and Mathematical Models of Innovation Project Appraisal .

• Current Status of Innovation Project Review and Appraisal . • Development of Methods and Models for Assessing Innovativeness and Competitiveness of Innovative Projects . • Development of Methods and Models for Assessing Feasibility and Cost-Effectiveness of Innovative Projects . • Development of an Information System of Innovation Project.

Session 6. Mathematical Methods for Making Investment Decisions .

• Basic Concepts of the Risk Theory of an Investment Project . • Investment Decisions: Project Choice and Risk Management . • Assessment of Investment Project in the Multi-criterion Context . • Probabilistic Approach to Quantitative Risk Assessment. • Quantitative Risk Analysis Based on the Methods of Fuzzy • Information Support for the Investment Project Analysis . • Filtration of Investment Projects . • Examples of Investment Decision-Making .

Session 7. Multi-Objective Stochastic Models for Making Decisions on Resource Allocation .

• Applicability of Multiple Criteria Optimization Methods . • The Decision-Making Problem of Resource Allocation in Terms of Utility Theory . •Formulation and Convolution of Criteria in Monocriterial Decision-Making Models . •Single-Stage Stochastic Models for Limited Resource Allocation with Probabilistic Constraints . . •Multi-Stage Stochastic Models of Limited Resource Allocation with Probabilistic Constraints . • Use of the Combined Policy Model for Making Decisions on Resource Allocation .

Session 8. Mathematical Methods and Models for Monitoring of Government Programs .

•Government Program as a Targeted System with Program Management . •Government Programs in Terms of Systems Theory and General Management Theory . •Information and Model Representation of Government Programs and Methods of Monitoring Their Implementation . •Methods and Models for Evaluation of GP Implementation .

Session 9. Methodology for Identification of Competitive Industrial Clusters .

•Cluster Analysis of Regions . . • Methods of Identification of Competitive Industrial Clusters .

LEARNING OUTCOMES

Knowledge:

- the basic mathematical models of economic theory and decision-making practice;
- meaningful and mathematical statements of the problems of economics and business, solved by economic and mathematical methods;
- basic economic and mathematical methods;
- the methodology and methodic for constructing the analysis and use of economic and mathematical models, the basic algorithms for solving them and computational aspects;

- a methodology for constructing an econometric model based on qualitative and quantitative analysis of the object of study.

Abilities:

- solve typical mathematical problems used in making decisions;
- to compile, use and analyze economic and mathematical methods and models for the complex solution of economic and social problems;
- plan, evaluate, develop and make effective decisions in a market economy;
- apply econometric models in business practices: to predict the behavior of business entities on the basis of such models, assess the financial condition of the company and develop and make optimal management decisions.

Skills:

- methods of constructing economic and mathematical models to solve various optimization problems;
- sufficient knowledge and skills to formulate the concept of an econometric model;
- tools for constructing with subsequent quality assessment of econometric models of the studied economic phenomena, processes and objects.

PLANNED LEARNING ACTIVITIES AND TEACHING METHODS

Each session lecturing accounts for about 60% of time, students' participation in discussion accounts for 40%. Specifically, the lecturer will invite students to speak during the lecture. At the end of each session, questions are presented for discussion.

During the seminars, students will have an opportunity to analyze some tasks and case studies, to work with open source software for economic and mathematical modeling and recognize how to deal with them by using information technologies.

Comprehensive development of student discipline involves:

- students involvement in problem-based presentation;
- students self-guided reading of the further literature;
- students participation in practices;
- testing;
- project;
- exam.

ASSESSMENT METHODS AND CRITERIA

Criteria for evaluation:

Practical tasks

The maximum number of points for practical tasks: 20 points

The correct and comprehensive answers to all proposed questions are given.	17-20
The correct, in general, answers to all proposed questions are given, however, there are minor comments on the completeness and quality of the presentation of the material.	12-16
There are significant comments on the completeness and quality of the presentation of the material or some of the issues remained unresolved	5-11
No answers to questions or incorrect answers.	0-4

Testing

The maximum number of points for tests: 20 points

The share of scores from their total number is equal to or exceeds 85% (excellent)	18-20
The share of scores from their total number is in the range from 65 to 84% (good).	12-17
The share of scores from their total number is in the range from 55 to 64% (satisfactory).	10-12
The share of scores from their total number is less than 55% (unsatisfactory)	0-9

Project Topics

The maximum number of points for project: 20 points

Relevance, purpose and objectives: the problem is clearly identified and its relevance is justified, the goal is formulated, the research objectives are defined. Structure: the text is divided into sections, there are no errors in text structuring. Design: volume is maintained, requirements for external design are met. The text contains at least one figure and one table. References: The requirements of GOST 7.32-2001 and GOST 7.0.5-2008 with respect to bibliography and references are met. References include textbooks, scientific and popular science journals, legal acts, and links to electronic publications. The age of the sources is not older than 5 years. Text quality: the analysis of the problem with the involvement of	18-20

several sources of literature is carried out, own position is logically stated, conclusions are formulated, the topic is fully disclosed, links to sources from the list of literature are indicated. Protection: demonstrates a complete understanding of the described problem, gives correct answers to all questions on the topic of the abstract	
Relevance, purpose and objectives: the problem is not clearly defined, there is a rationale for its relevance, a goal is formulated, the research objectives are defined. Structure: the text is divided into sections, there are no gross errors in text structuring. Design: the text of the project is framed with minor violations of the design requirements set forth in this document, the volume is maintained. The text contains at least one figure and one table. References: when designing a project, most of the requirements of GOST 7.32-2001 and GOST 7.0.5-2008 with respect to bibliography and references are met. References include textbooks, scientific and popular science journals, legal acts, and links to electronic publications. The age of the sources is not older than 5 years. Text quality: the analysis of the problem with the involvement of several sources of literature is carried out, own position is logically stated, conclusions are formulated, the topic is fully disclosed, links to sources from the list of literature are indicated. Protection: demonstrates a significant understanding of the problem; not all questions are answered or incomplete answers	13-17
Relevance, purpose and objectives: the relevance of the problem is insufficiently substantiated, the purpose and objectives of the study are not formulated. Structure: the text is divided into sections, there are errors in text structuring. Design: The text of the project is framed with violations of the design requirements set forth in this document, the volume is not maintained, there are no figures and tables. References: during the design of the project, the requirements of GOST 7.32-2001 and GOST 7.0.5-2008 with respect to bibliography and references are partially observed. The list of references is framed with violations of the quality and age requirements of the sources. Text quality: the analysis of the problem was carried out according to one source of literature, there are no conclusions, the topic is not fully disclosed.	8-12

Protection: demonstrates a partial understanding of the problem, answers are given only to basic questions.	
Relevance, purpose and objectives: there is clearly no justification for the relevance of the problem, the purpose and objectives of the study. Structure: the text is not divided into sections or there are gross errors in structuring the text. Design: the text of the project is framed with gross violations of the design requirements set forth in this document. References: during the design of the project, most of the requirements of GOST 7.32-2001 and GOST 7.0.5-2008 with respect to bibliography and references are not complied with or there is no literature list. Text quality: the topic is not disclosed, the requirements for the task are not fulfilled. Protection: demonstrates a lack of understanding of the problem, there are no answers to questions or answers are incorrect	0-7

Exam

The maximum number of points for exam questions : 40 points

The correct and comprehensive answers to all proposed questions are given.	30-40
Given the correct, in general, answers to all proposed questions, however, there are minor comments on the completeness and quality of the presentation	20-29
There are significant comments on the completeness and quality of the presentation of the material or some of the issues remained unresolved	10-19
No answers to questions or incorrect answers.	0-9

COURSE LITERATURE (RECOMMENDED OR REQUIRED)

1. Mutanov G. Mathematical Methods and Models in Economic Planning, Management and Budgeting. Springer. 2015. – 356 p. https://link.springer.com/content/pdf/bfm%3A978-3-662-45142-7%2F1.pdf
2. Econometrics for bachelors / V.N. Afanasyev - Third Edition, revised and enlarged - Orenburg: IPK Universitet LLC, 2014. - 434 http://biblioclub.ru/index.php?page=book&id=330491]
3. Econometrics: a textbook / K.V. Baldin, V.N. Bashlykov, V.A. Bryzgalov and

others; under the editorship of B. B. Utkin. - 2nd ed. - M.: Dashkov & Co., 2013. - 562 with http://biblioclub.ru/index.php?page=book&id=253800]

4. Vakhrusheva N.V. Financial mathematics / N.V. Vakhrusheva - M. | Berlin: Direct Media, 2014. - 180 p. http://biblioclub.ru/index.php?page=book&id=258793

5. Methods and models of econometrics. 2: Econometrics of spatial data / O.I. Bantikova - Orenburg: Orenburg State University, 2015 .-- 435 p. http://biblioclub.ru/index.php?page=book&id=36484113

6. Economics and mathematical methods, 1996-2019, v.32-55 http://www.cemi.rssi.ru/emm/cont_f-e.htm