


EDUCATIONAL AND CURRICULAR DOCUMENTATION ¹

Educational establishment
«Belarus State Economic University»

APPROVED

Rector of Educational
establishment «Belarus State
Economic University»



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Registration No UD 4281-20 st.

APPLIED QUANTITATIVE METHODS IN MANAGEMENT

Syllabus for Master's program
1-26 80 03 «Business Administration»

MINSK 2020

¹ The original curriculum of the institution of higher education is kept at the Department of Economic Informatics

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RECOMMENDED FOR APPROVAL BY:

Department of Economic Informatics of educational establishment «Belarus State Economic University»

(minutes № 8 on «22» 01 2020);

The scientific-methodical Council of the educational establishment «Belarus State Economic University»

(minutes № 4 on «26» 02 2020).

EXPLANATORY NOTE

The purpose of the discipline «Applied quantitative methods in management» is to familiarize students with various types of tasks of effective business management.

They form the skills of conducting economic calculations and their use for the development and justification of managerial decisions in economic systems of different levels.

The main objectives of the discipline:

- study of the basic principles of the theory of systems analysis in economics and management;
- the formation of a basic set of applied quantitative methods of analysis;
- application of statistical analysis methods;
- the formation of skills and abilities to use econometric methods of analysis and forecasting in business;
- acquiring skills in using balance methods for solving economic problems;
- the use of a linear dual optimization problem in the analysis of the efficiency of managing the production consumption of resources;
- training in quantitative methods for the formation of weight coefficients in the criteria for making managerial decisions of an algebraic form;
- training in quantitative rating methods in business.

In accordance with the curriculum the academic discipline consists of 200 academic hours, including 68 hours in the class. Distribution by occupation is the following: lectures – 34 hours; laboratory classes – 34 hours. Form of the current certification is the exam.

As a result of studying this academic discipline master student must **know:**

- the main principles of system analysis in the economy, which form the basis for the development and use of quantitative methods for calculating;
- statistical methods of analysis;
- econometric methods for solving problems;
- methods for analyzing resource consumption using the dual linear programming problem;
- balance methods of analysis in multilevel economic systems;
- quantitative methods for the formation of integrated economic indicators and the establishment of their weighting factors;
- Saati hierarchy analysis method in management;

be able to:

- substantiate the choice of applied quantitative methods of analysis and forecasting in business;
- use them to solve a different class of economic management problems;
- form, process and analyze databases to solve practical business problems in the face of uncertainty;

have skills:

- of conducting quantitative calculations for different classes of business problems using software packages (for example, MS Excel);
- of application of statistical, balance, econometric and optimization methods for solving applied problems;
- to apply the results for management decisions.

To study this academic discipline a student needs to know the basics of higher mathematics, probability theory, mathematical statistics, econometrics, mathematical programming, operations research and computer information technologies.

THE CONTENT OF EDUCATIONAL MATERIAL

Introduction

Applied quantitative methods in business management, their classification. The role and place of mathematical modeling methods in economics and business.

Topic 1. Basis of systems analysis in economic management

The basic concepts of cybernetics: system, model, information, management. The solution of economic problems by quantitative methods in continuous and discrete time. The content of the problems of analysis, synthesis and management in business.

Topic 2. Balance analysis methods in business management

A balanced system of organization indicators and its use in model linking of the main functional subsystems at the micro level (in the organization). Quantitative methods of budget planning in the organization. Balance methods of macroeconomic regulation. Intersectoral (input-output) balance method. Modifications of the intersectoral balance method with regard to regional and dynamic characteristics of analysis and management.

Topic 3. Statistical methods for substantiating of management decisions

Statistical data system. Generation of cross-sectional and time-series observed statistical data. Probabilistic-statistical and logical-algebraic approaches to the analysis and interpretation of economic data. Data homogeneity, statistical criterion for checking data homogeneity. Irregularity of distribution of objects and quantitative methods for its measurement, Gini coefficient and Lorentz curve. Deterministic and stochastic methods of analysis and management in business.

Topic 4. Econometric methods for substantiating of management decisions

The content of econometric methods and models of analysis in business. The classical and generalized linear multiple regression problems, the ordinary and generalized least squares methods for estimating parameters, point and interval forecasts of the analyzed economic indicators. A class of economic problems which is based on nonlinear regression models.

Topic 5. Optimization dual problem of linear programming in assessing the efficiency of managing the consumption of material resources

The economic content of duality theorems in the linear programming problem. Interpretation of optimal dual estimates of production resources. The stability intervals of the optimal dual variables calculated separately for each variable while the others are fixed. The limitations of this method of calculating the interval for

economic conclusions. The establishment of the stability of the optimal dual variables under the changing of consumed resources. The construction of a fundamental set of solutions that allows analytic observation of an infinite set of simultaneous changes of resources under which the optimal dual estimates are unchanged. The use of optimal dual estimates under simultaneous changes of consumed resources as the indicators of the effectiveness of their management (scenarios of managing the production consumption of resources).

Topic 6. Applied quantitative methods of generating generalized indicators and rating systems of evaluating business management effectiveness

The essence of the formation of generalized economic indicators based on a set of private indicators. Statistical techniques of generating integral indicators for quantitative analysis. Methods of algebraic transformation of the original table of private indicators. Using the length of the vector of variables (indicators) normalized to unity and the angle between the vectors for quantitative analysis. Polar coordinate system (petal diagram or «radar» diagram) for graphical interpretation of the comparative assessment of objects by integral indicators. The use of logical analytical functions in the generation of integral indicators and rating assessment of management effectiveness. Harrington's desirability function and logistic regression function.

Topic 7. Applied quantitative methods of substantiating of the construction of hierarchical structures for managing a business problem

Task setting of composition and decomposition of objects and indicators in structuring the processes of developing management decisions. The method of pairwise comparisons of features in establishing their significance or priority of decision making. Statistical methods of pairwise comparative analysis of indicators for determine their weights for a given set (this system) of indicators. Saati hierarchy analysis method. The use of linear algebra methods for establishing the main quantitative characteristics of the priority of indicators in their hierarchical structure.

**EDUCATIONAL-METHODICAL DISCIPLINE MAP « APPLIED QUANTITATIVE METHODS IN MANAGEMENT »
FOR THE FULL-TIME FORM MASTER'S PROGRAM**

Topic's number	Topic	The number of classroom hours					Other*	Form of the knowledge control	
		Lectures	Practical lessons	Seminars	Laboratory lessons	The number of control independent work hours			
						Lectures			Laboratory lessons
	Introduction	2					2	[1-3]	
1	Basis of systems analysis in economic management	2			2			[1-3]	
2	Balance analysis methods in business management	4			4			[1-3]	
3	Statistical methods for substantiating of management decisions	6			6			[1-3]	Test
4	Econometric methods for substantiating of management decisions	6			8			[1-3]	
5	Optimization dual problem of linear programming in assessing the efficiency of managing the consumption of material resources	6			6			[1-3]	Test
6	Applied quantitative methods of generating generalized indicators and rating systems of evaluating business management effectiveness	4			4			[1-3]	
7	Applied quantitative methods of substantiating of the construction of hierarchical structures for managing a business problem	4			4			[1-3]	Test
	Total hours	34			34				Exam

* section «Other» consists of references in square brackets.

**EDUCATIONAL-METHODICAL DISCIPLINE MAP « APPLIED QUANTITATIVE METHODS IN MANAGEMENT »
FOR THE PART-TIME MASTER'S PROGRAM**

Topic's number	Topic	The number of classroom hours					Other*	Form of the knowledge control	
		Lectures	Practical lessons	Seminars	Laboratory lessons	The number of control independent work hours			
						Lectures			Laboratory lessons
	Introduction						2	[1-3]	
1	Basis of systems analysis in economic management							[1-3]	
2	Balance analysis methods in business management	1			1			[1-3]	
3	Statistical methods for substantiating of management decisions	2			2			[1-3]	Test
4	Econometric methods for substantiating of management decisions							[1-3]	
5	Optimization dual problem of linear programming in assessing the efficiency of managing the consumption of material resources	2			2			[1-3]	Test
6	Applied quantitative methods of generating generalized indicators and rating systems of evaluating business management effectiveness	1			1			[1-3]	
7	Applied quantitative methods of substantiating of the construction of hierarchical structures for managing a business problem	2			2			[1-3]	Test
	Total hours	8			8				Exam

* section «Other» consists of references in square brackets.

INFORMATIONAL AND METHODOLOGICAL PART

Methodical recommendations on the organization of master students independent work in academic discipline

«Applied quantitative methods in management»

An important stage of the studying of the academic discipline is the independent work of master students. Budget of the time for independent work is recommended as, on average, 1,5-2 per 2-hours classroom lesson.

The main directions of the master student independent work are:

- detailed acquaintance with the program of the academic discipline;
- acquaintance with the list of recommended references on the academic discipline in general and its sections, the study of necessary literature on the topics of the syllabus, the selection of necessary information in additional literature;
- study and expansion of the lecture material due to the special literature and consultations;
- preparation for laboratory exercises in accordance with specially developed plans and using basic and additional references;
- preparation for the implementation of diagnostic monitoring forms (control practical tasks, tests);
- preparation for exam.

References

Basic:

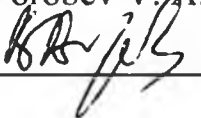
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Additional:

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MINUTES OF SYLLABUS ENDORSEMENT

Title of the academic discipline with the current discipline should be endorse	Department	Suggestions of changes in the syllabus content	Decision of the department (with the number and date of the minutes)
Management economics	Economic Theory	Vorobev V. A. 	Minutes № <u>9</u> « <u>22</u> » <u>01</u> 20 <u>20</u>

SYLLABUS ADDITIONS AND CHANGES

in ____ / ____ academic year

№	Additions and changes	Reasons

Syllabus is re-considered and approved on the meeting of the department of _____
(minutes № ____ on _____ 20__)

Head of the department

APPROVE
Director of the Institute
of Masters Programs
