MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SUMY NATIONAL AGRARIAN UNIVERSITY

Cybernetics and Informatics Department

«CONFIRMED»

Head of Cybernetics and Informatics Department

«___»_____2020y.
_____(S. Ahadzhanova)

CURRICULUM

OPERATIONS RESEARCH

Specialty: **073“Management”**

Educational program **Management of Organizations and Administration**

Faculty: **Economics and Management**

2020– 2021 academic year

Curriculum of ***Operations research*** was worked out for the second-year students of sspecialty 073“Management”.

Author: **Associate Professor, PhD S. Agadzhanova**

Curriculum has been approved on the Cybernetics and Informatics Department Meeting.

Protocol # 10 from 17.06.2020 year

Cybernetics and Informatics Department **S. Ahadzhanova**

Coordinated by:
Guarantor of educational and professional program

(project team leader) _____

Dean of the Faculty _____

Methodist of the Department

of Education Quality,

licensing and accreditation _____

Registered in electronic data base _____

Description of educational discipline

<table>
<tr><th>Indicators</th><th>Branch of knowledge, training direction, qualification level</th><th>Characteristics of course</th></tr>
<tr><td>Number of credits-3</td><td>Branch of knowledge 0306 “Management and Administrating”</td><td>Normative</td></tr>
<tr><td>Modules -2</td><td rowspan="5">Specialty: 073”Management”</td><td>Years</td></tr>
<tr><td>Content modules -2</td><td>2020 – 2021</td></tr>
<tr><td rowspan="3">Individual scientific research task</td><td>Course</td></tr>
<tr><td>2</td></tr>
<tr><td>Semester</td></tr>
<tr><td>Total quantity, hours-90</td><td>3</td></tr>
<tr><td rowspan="10">Week classes for full day studing:
classes – 2,6
individual - 2,4</td><td rowspan="10">Educational level: bachelor</td><td>Lectures</td></tr>
<tr><td>30</td></tr>
<tr><td>Practical classes</td></tr>
<tr><td>16</td></tr>
<tr><td>Labs</td></tr>
<tr><td></td></tr>
<tr><td>Individual work</td></tr>
<tr><td>44</td></tr>
<tr><td>Individual tasks</td></tr>
<tr><td>Forms of Control</td></tr>
<tr><td>Exam</td></tr>
</table>

Note .

Correlation of numbers of classes to individual work is *51,1/48,9* (46/44)

1. Aim and Tasks

Aim: operational research (O.R.) is the discipline of applying advanced analytical methods to help make better decisions.

The course in Operational Research aims to realize the potential of graduates, so that you immediately can play an effective role in providing model-based support to managers helping them to make better decisions at an operational/technical level.

You'll develop a rigorous academic understanding of advanced analytical methods that are used to provide structured and analytical approaches to decision-making. You'll also develop practical skills in using operational research models to support decision-makers.

Tasks:

By using techniques such as problem structuring methods (sometimes known as 'Soft O.R.') and mathematical modelling to analyze complex situations, operational research gives executives the power to make more effective decisions and build more productive systems based on:

- More complete data
- Consideration of all available options
- Careful predictions of outcomes and estimates of risk
- The latest decision tools and techniques

Once a good or better way of proceeding has been identified, OR people are often central to the implementation of the proposed change. Organizations may seek a very wide range of operational improvements - for example, greater efficiency, better customer service, higher quality or lower cost. Whatever the business engineering aim, OR can offer the flexibility and adaptability to provide objective help.

Most of the problems OR tackles are messy and complex, often entailing considerable uncertainty. OR can use advanced quantitative methods, modelling, problem structuring, simulation and other analytical techniques to examine assumptions, facilitate an in -depth understanding and decide on practical action.

The study of the discipline "***Operations Research***" involves the formation of students' competencies (derived from the educational and professional program):

№	Type of program competencies	Program competence	Code
	General		
1		Ability to abstract thinking, analysis and synthesis and establishing relationships between socio-economic phenomena and processes.	ЗК 1
2		Ability to learn and master modern knowledge	ЗК 6
3		Ability to adapt, be creative, generate ideas and actions in a new situation	ЗК 7
	Special (professional, subject) competencies		
4		Ability to analyze the results of the organization' activity, compare them with the factors of external and internal environment, to determine the prospects for the organization.	ФК2

5		Ability to manage the organization and its divisions through the implementation of management functions	ФК4
6		Ability to choose and use modern management tools.	ФК5
7		Ability to plan and manage time.	ФК6
8		Ability to analyze and structure the problems of the organization, to form to form reasonable decisions.	ФК9

2.3 Program learning outcomes

As a result of studying the discipline " ***Operations Research*** " the student must be able to demonstrate the following learning outcomes (derived from the educational-professional program):

№	Program learning outcomes	Code
1	Demonstrate skills of search, collection and analysis of information, calculation of indicators to substantiate management decisions.	ПРН 6
2	Be able to use modern information technologies, blockchain technologies in the management of resources and databases to justify management decisions on the choice of innovative technologies in agricultural enterprises.	ПРН 19

2. Program of Discipline

(*approved by academic Council of SNAU Protocol #67 from 24.05.17y*)

Content module 1. *Basic items of Operational Research.*

Topic 1. Foundations of Operations Research.

This class will explore the generic problem solving process which underpins the provision of decision support. In particular, it'll consider the role of modelling in that process. The activities of problem structuring, data collection and analysis, identification and evaluation of options, communication and implementation of learning, findings and recommendations will each be discussed along with the issues pertaining to each of them.

Topic 2. Operational Research Methods.

This module introduces the fundamental deterministic and stochastic methods of OR. Probabilistic modeling is fundamental to appreciating uncertainty and risk. This element of the class provides much of the foundations that underpin the tools and techniques that are taught on other classes of the students such as statistics, forecasting, risk and simulation.

The module also introduces students into the basic deterministic models and methods of OR.

Content module 1. *Overview of Linear Programming Methods.*

Topic 3. Linear programming (LP). Geometrical description of LP solution. Definitions of LP problem. Standard and vectorial forms of LP problem. Variables, constraints, objective functions. Steps of analytical solution.

Topic 4. Solving LP Problems with Excel. Creating of a model. Steps of solution. Solver. Function SUM.

Topic 5. Simplex method. History, founders. Advantages of simplex method. Types of solution. Definition of vertex corner. Pivot element. Function SUMPRODUCT.

Topic 6. Transportation. Standard form of transportation problem model. Methods of solution. Mathematical model. Solution in MS Excel.

Topic 7. Transshipment and Assignment problems. Standard form of transshipment problem model. Methods of solution. Mathematical model. Solution in MS Excel. Assignment problem. Methods of decision.

Topic 8. Duality. Definition of a problem. Mathematical model. Primal and Dual parts of a model. Tasks. First and Second Theorems of Duality.

4. Structure of training discipline

Name of content modules and topics	Number of hours					
	total	also				
		Lectures	PC	Labs	IW	IT
1	2	3	4	5	6	7
Module 1. Object, content and main items of course.						
Content module 1. ***Basic items of Operational Research.***						
Topic 1. Foundations of Operational Research.	**6**	**2**	**-**			**4**
Topic 2. Operational Research Methods.	**6**	**2**	**-**			**4**
Total module 1	**12**	**4**	**-**			**8**
Module 2. Solving the different economics tasks by OR methods.						
Content module 1. ***Overview of Linear programming Methods.***						
Topic 3. Linear programming (LP). Geometrical description of LP solution	**4**	2	2			
Topic 4. Solving LP Problems with Excel	**14**	2	2			**10**
Topic 5. Simplex method	**6**	4	2			**-**
Topic 6. Transportation problem.	**22**	6	2			**12**
Topic 7. Transshipment and Assignment problems	**22**	6	2		**-**	**14**
Topic 8. Duality	**10**	6	4			**-**
Total module 2	**78**	**26**	**16**			**36**
TOTAL	**90**	**30**	**16**			**44**

5.Topics of lectures

№	*Name of topics*	*Quantity of hours*
1	**Topic 1.** Foundations of Operational Research. 1. History of Operations Research 2. Stages of Development of Operations Research 3. Relationship Between Manager and OR Specialist.	2
2	**Topic 2**. O.R. Tools and Techniques. Applications of Operations Research. 1. OR Tools and Techniques 2. Applications of Operations Research 3. Limitations of Operations Research	2
3	**Topic 3.** Linear programming (LP). Geometrical description of LP solution. 1. Standard form of LP model. 2. Steps of analytical decision, graphical method.	2
4	**Topic 4.** Solving LP Problems with Excel. 1. Creation of LP model in MS Excel. 2. Solution LP problem in MS Excel, steps.	2
5	**Topic 5(part 1).** Simplex method**.** 1. Simplex method, characteristics. 2. 2. Classification of simplex method technologies.	2
6	**Topic 6(part 2).** Simplex method**.** 1. Solution LP problem by simplex method in MS Excel.	4
7	**Topic 7.** Transportation problem. 1. Entity of transportation problem. 2. Types of transportation problem.	4
8	**Topic 8.** Transshipment and Assignment problems. 1. Solution of TP. 2. Transshipment problem. 3. Assignment problem.	6
9	**Topic 9.** Duality. 1. Entity of duality problem. 2. Structure of solution. 3. Main steps of primal and dual parts of solution in MS Excel.	6
	Total:	**30**

6. Topics of practical classes

№	*Name of topics*	*Quantity of hours*
1.	***Practical work 1.*** Graphical method for solving linear programming tasks.	**2**
2.	***Practical work 2.*** Solving linear programming tasks in MS Excel.	**2**
3.	***Practical work 3.*** Simplex method for solving linear programming tasks in MS Excel.	**2**
4.	***Practical work 4.*** Transportation problem.	**2**
5.	***Practical work 5.*** Assignment problem, solution in MS Excel.	**2**
6.	***Practical work 6.*** Integer Programming.	**2**
7.	***Practical work 7.*** Matrix operations in MS Excel.	**2**
8.	***Practical work 8.*** Duality.	**2**
	Total:	**16**

7. Topics and plans of individual task

№	*Name of topics*	*Quantity of hours*
	Topic 1. Foundations of Operational Research & Business Analysis	4
	Topic 2. Quantitative Business Analysis(part 1).	4
	Topic 3. Quantitative Business Analysis(part 2).	4
	Topic 4. Managing Business Operations	4
	Topic 5. Spreadsheet Modeling & Demand Forecasting	4
	Topic 6. Operational Research Methods	2
	Topic 7. Becoming an effective OR Modeler	4
	Topic 8. Business Simulation Methods.	4
	Topic 9. Risk Analysis & Management	4
	Topic 10. Decision Analysis	4
	Topic 11. Project/Dissertation	4
	Topic 12. Advanced OR Modeling Using Special Software Tools	2
Total:		**44**

9. Methods of Training

1. Methods of studies after the source of knowledge:

1.1. ***Verbal***: a story, explanation, lecture, instructing, work, is with a book (reading, summarizing, making of tables, graphs).

1.2. ***Evident***: demonstration, illustration.

1.3. ***Practical***: laboratory method, practical work.

2. Methods of studies after character of logic of cognition.

2.1. ***Analytical.***

2.2. ***Methods of synthesis***.

3. Methods of studies after character and level of independent intellection of students.

3.1. ***Problem*** (whether problem informative)

3.2. ***Partly searching (heuristic)***

3.3. ***Research***

4. Active methods of studies - usage of e-learning technologies, self-appraisal knowledge, educational and supervisory tests.

5. Interactive technologies of studies - usage of multimedia technologies, kahoot, mind maps.

10. Methods of Control

1. Rating control is after the 100-point scale of evaluation of ECTS.

2. Lead through of intermediate control is during a semester (intermediate attestation)

3. Polikriterial estimation of current work of students:
- level of knowledge, shown on practical and laboratory employments;
- activity is during the job processing on employment;
- results of implementation and defense of laboratory works;
- express control during audience employments;
- the independent working with theme(whole or separate questions);
- registration of abstracts, reports;
- testing results;
- written tasks during the lead through of control works.

12. Points for Exam

Current testing and independent work													**Modules + IT**	**Attestation**	**Sum test-exam**	**Sum**
Content module 1 - 20 points						**Content module 2 - 20 points**						**IT**				
T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	**15**	**55 (40+ 15)**	**15**	**30**	**100**
2,5	2,5	2,5	5	5	2,5	2,5	2,5	2,5	5	5	2,5					

Evaluation scale: national and ECTS

Total points	**ECTS**	**National rating**
		Exams, term paper, practice
90 – 100	**A**	Excellent
82-89	**B**	Good
75-81	**C**	
69-74	**D**	Satisfactory
60-68	**E**	
35-59	**FX**	Unsatisfactory
1-34	**F**	Poor

Methodical ware:

1. S. Agadzhanova Operations Research[e-course]: **https://cdn.snau.edu.ua/moodle/course/view.php?id=2605**

2. Bibliography:

1. S.Agadzhanova Operations research: конспект лекцій. Суми, 2018 рік, ст.72, табл.14, рис.34. Рекомендовано до видання методичною радою факультету економіки і менеджменту. Протокол №6 від 23.05.2018р.
2. About Operations Research. INFORMS.org. Retrieved 7 January 2012.
3. Mathematics Subject Classification. American Mathematical Society. 23 May 2011. Retrieved 7 January 2012.
4. What is OR. HSOR.org. Retrieved 13 November 2011.
5. Operations Research Analysts. Bls.gov. Retrieved 27 January 2012.
6. OR / Pubs / IOL Home. INFORMS.org. 2 January 2009. Archived from the original on 27 May 2009. Retrieved 13 November 2011.
7. M.S. Sodhi, What about the 'O' in O.R.? OR/MS Today, December, 2007, p. 12, http://www.lionhrtpub.com/orms/orms-12-07/frqed.html
8. Operations research (industrial engineering) :: History – Britannica Online Encyclopedia". Britannica.com. Retrieved 13 November 2011.
9. Frederick S. Hillier & Gerald J. Lieberman, *Introduction to Operations Research*, McGraw-Hill: Boston MA; 10th Edition, 2014

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Registered in electronic data base 23.07. _____