Annex 2
To the procedure of the development and periodic review of educational programs

1. General Information	
Faculty	Faculty of Foreign Students
Programme	22 Healthcare, 226 Pharmacy
Academic year	2023–2024
Subject	Basics of system analysis ВБ 1.17
Department	Biophysics Department 70010, Lviv, 3a Shymzeriv +38 (032) 2-75-58-76 Kaf_biophysics@meduniv.lviv.ua
Head of the Department	Roman Fafula, Dr. Sci., Professor Kaf_biophysics@meduniv.lviv.ua
Year	II
Semester	II
Type of the Subject	elective course
Professors	Oksana Malanchuk, Associate Professor, PhD Kaf_biophysics@meduniv.lviv.ua
Erasmus yes/no	-
Responsible for Syllabus	Oksana Malanchuk, Associate Professor, PhD oksana.malan@gmail.com
Credits ECTS	3
Hours	Lectures – 10 h Practical classes – 20 h Individual work – 60 h
Language of Instruction	English
Consultations	According to the schedule

2. Brief review of the subject

The subject of the discipline "Basics of system analysis" is the knowledge of the basic structures and stages of system analysis and basics of decision making and situational modeling used in pharmacy.

According to the curriculum "Basics of system analysis" is one of the subjects that form the theoretical basis for training of highly qualified pharmaceutical specialists**.**

The study of this discipline forms the basic understanding of the general principles of system analysis of medical and pharmaceutical information, techniques and methods for their analysis.

According to the curriculum, the subject «Basics of system analysis» is divided into 2 content modules, which consist of a lecture course (10 hours), practical classes (20 hours) and individual work of students (60 hours).

3. Purpose and objectives of the Subject

The **aim** of studing the discipline "Fundamentals of system analysis" are learning:

- the concept of the system, system resources, system procedures and methods;
- types of system topologies for determining characteristics and solving optimization problems;
- main types and classes of systems of varying complexity;
- principles of creation and management in information systems;
- the concept of decision-making, the life cycle of the system;
- situational simulation to solve specific problems;
- mathematical models when calculating the average system performance;

- interdependence of the features on the basis of exponential dependencies.

Achieving these objectives will allow a pharmaceutical students to master the knowledge and skills which are necessary for training a pharmacist and for study of other theoretical and applied academic disciplines.

Achieving these objectives will allow a pharmaceutical students to master the mathematical knowledge and skills which are necessary for training a pharmacist and for study of other theoretical and clinical disciplines in the higher educational establishments and ensure the formation of general and special competencies and learning outcomes.

Integral competence:

The ability to apply the acquired general and professional competences to solve complex problems in professional pharmaceutical activity, including research and innovation; performing professional activities in the relevant position, including the manufacture/development of drugs, their storage, quality control, delivery, distribution, dispensing, provision of medicinal products means, as well as counseling, provision of information on medicines and monitoring of side effects and/or ineffectiveness of drug therapy; implementation of innovations.

General competences:

GC01. Ability to abstract thinking, analysis and synthesis.

GC03. Ability to communicate in the national language both orally and in writing.

GC04. The ability to communicate in a foreign language (mainly English) at a level that ensures effective professional activity

GC05. The ability to evaluate and ensure the quality of the work performed.

GC09. Ability to use information and communication technologies.

Special (professional) competences:

PC01. Ability to integrate knowledge and solve complex pharmacy/industrial pharmacy problems in broad or multidisciplinary contexts.

PC03. Ability to solve pharmacy problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility., to form the prices of medications and medical products in accordance with the current legislation of Ukraine.

PC13. The ability to organize the activities of pharmacies to provide the population and health care facilities with medicines and other products of the pharmacy assortment under normal conditions and under emergency conditions, as well as to implement appropriate reporting and accounting systems in them, to carry out commodity analysis, administrative record-keeping taking into account the requirements of pharmaceutical legislation.

PC14. The ability to analyze and forecast the main economic indicators of the activity of pharmacies, to calculate the main taxes and fees, to form prices for medicinal products and other products of the pharmacy assortment in accordance with the legislation of Ukraine.

PC15. The ability to analyze socio-economic processes in pharmacy, forms, methods and functions of the system of pharmaceutical provision of the population and its components in global practice, indicators of the need, effectiveness and availability of pharmaceutical care in terms of medical insurance and reimbursement of the cost of medicines.

Integrative final program learning outcomes (PLO) of the discipline "Basics of system analysis" are:

PLO03. Possess specialized knowledge and abilities/skills for solving professional problems and tasks, including for the purpose of improving knowledge and procedures in the field of pharmacy. (GC01, GC05, GC09, PC01, PC03, PC13, PC14, PC15)

PLO04. Communicate freely in the national and English languages orally and in writing to discuss professional problems and results of activities, presentation of scientific research and innovative projects. (GC03, GC04)

PLO05. Assess and ensure the quality and efficiency of activities in the field of pharmacy in standard and non-standard situations; adhere to the principles of deontology and ethics in professional activity (GC01, GC05, GC09, PC01, PC03, PC13, PC14, PC15).

PLO07. Analyze the necessary information on the development and production of medicinal products, using professional literature, patents, databases and other sources; systematize,

analyze and evaluate it, in particular, using statistical analysis. (GC01, GC03, GC04, GC09, PC01, PC03, PC13, PC14, PC15)

PLO18. To use data from the analysis of socio-economic processes in society for the pharmaceutical supply of the population, to determine the effectiveness and availability of pharmaceutical care in terms of medical insurance and reimbursement of the cost of medicines. (ZK01, ZK05, ZK09, FC01, FC14)

PLO23. Determine the main chemical and pharmaceutical characteristics of medicinal products; choose and/or develop quality control methods for the purpose of their standardization using physical, chemical, physicochemical, biological, microbiological and pharmacotechnological methods in accordance with current requirements. (GC01, GC05, GC09, PC01, PC03, PC13).

4. Preliminary requirements

To successfully master the subject «Basics of system analysis» the student must have the following knowledge and skills:

1. Knowledge of basic concepts, formulas and the ability to use differential and integral calculus for high school mathematics.
2. Knowledge of the elements of combinatorics, the beginnings of probability theory and elements of mathematical statistics in the course of high school mathematics, the ability to apply to solve simple problems.
3. Ability to think abstractly, analyze and the ability to synthesize knowledge.
4. Ability to apply knowledge in practice.
5. Ability to search, process and analyze information from various sources.

5. Results of the Course

Results

Code	Results	Matrix of competencies
Зн-1	✓ Interpret the concept of system, system resources, system procedures and methods, system thinking.	*PLO 3, PLO 4, PLO 5, PLO23.*
Зн-2	✓ Know the types of topology of systems to determine the characteristics and solve optimization problems.	*PLO 4, PLO 18, PLO 23*
Зн-3	✓ know the basic types and classes of systems of varying complexity.	*PLO 3, PLO5, PLO 23.*
Зн-4	✓ know the principles of creation and management in information systems.	*PLO 3, PLO 5, PLO 7, PLO 23.*
Зн-5	✓ Know the concept of decision making, system life cycle, average system maintenance time.	*PLO 3, PLO 5, PLO 18. PLO23*
Зн-6	✓ Know the theory of situational modeling to solve specific problems.	*PLO 3, PLO 5, PLO 7, PLO 18, PLO 23.*
Зн-7	✓ Know mathematical models when calculating the average of the system.	*PLO 3, PLO 7, PLO 18, PLO 23.*
Зн-8	✓ Model the interdependence of features based on exponential dependencies.	*PLO 7, PLO 18, PLO 23.*
Ум-1	✓ Apply types of system topology to determine the characteristics and solve optimization problems.	*PLO 3, PLO 7, PLO 18*
Ум-2	✓ Distinguish the main types and classes of systems of varying complexity.	*PLO 3, PLO 5, PLO 7. PLO4, PLO7, PLO23.*
Ум-3	✓ Analyze types and classes of information.	*PLO 3, PLO 4, PLO 5, PLO 7.*
Ум-4		

Ум-5 *Ум-6* *Ум-7* *Ум-8*	✓ Analyze the principles of creation and management in information systems. ✓ Interpret the concept of decision making, system life cycle, average system service time. ✓ Apply situational modeling to solve specific problems. ✓ Apply mathematical models when calculating the average performance of the system. ✓ Model the interdependence of features based on exponential dependencies.	*PLO 3, PLO 5, PLO 7, PLO 18, PLO 23.* *PLO 3, PLO 5, PLO 7, PLO 18, PLO23.* *PLO 3, PLO 7, PLO18, PLO23.* *PLO 3, PLO 7, PLO 18, PLO 23.*
K-1 *K-2*	✓ ability to apply knowledge in practical situations; ✓ ability to conduct research at the appropriate level.	*PLO3, PLO4, PLO5, PLO7, PLO 18, PLO23.* *PLO3, PLO4, PLO5, PLO7, PLO 18, PLO23.*
AB-1 *AB-2* *AB-3*	✓ experience of independent subject activity, such as educational-cognitive, analytical, ability to synthesis of knowledge; ✓ ability to self-study and continuation of professional development; ✓ ability to control, self-control of learning outcomes.	*PLO3, PLO4, PLO5, PLO7, PLO 18, PLO23.* *PLO4, PLO7, PLO 18.* *PLO 7, PLO 18, PLO 23.*

6. Course content

Course	Full-time form of education	
Classes	**Hours**	**Groups**
Lectures	**10**	1
Practical	**20**	1
Individual	**60**	1

7. Course content

Code	**Topic**	**Content**	**Code**	**Professors**
L-1	History, subject, objectives of system analysis. Descriptions, basic structures and stages of system analysis. Functioning and development of the system. Classification of systems.	The history of development and the subject of system analysis, system resources of society, the subject area of system analysis, system procedures and methods, system thinking. The basic notions of system analysis, system features, types of system topologies, various forms of description of systems, stages of system analysis.	3H-1 K-1 AB-1	
L-2	Information, knowledge, the system. Principles of creation and manage-ment in information systems.	Different aspects of the concept of "information", types and classes of information, methods and procedures for updating information, ways of entering the measure of measuring the amount of information, the relationship	3H-2 3H-3 3H-4 K-1 AB-1	

		with the change of information in the system, examples.		
L-3	Fundamentals of system simulation. Mathematical and computer modeling.	Basic concepts of modeling of systems, system types and properties of models, life cycle of model, basic concepts of mathematical and computer modeling, computational experiment, operations of modeling.	ЗН-5 К-1 АВ-2	
L-4	The theory of mass service.	The main structural elements of the service system and the construction of flow patterns of pharmacy orders, taking into account the hierarchy of priorities.	ЗН-8 К-1 АВ-1	
L-5	Basics of decision making and situational modeling. New technologies of system analysis and design.	The basic concepts of decision making theories and situational modeling of systems. Review and classification of new information technology which most relevant for the analysis and modeling of systems, examples from the pharmaceutical industry.	ЗН-6 К-1 АВ-2	
PC-1	History, subject, objectives of system analysis. Descriptions, basic structures and stages of system analysis.	The history of development and the subject of system analysis, system resources of society, the subject area of system analysis, system procedures and methods, system thinking.		
PC-2	Functioning and development of the system.	The basic notions of system analysis, system features, types of system topologies, various forms of description of systems, stages of system analysis.	Зн-1 Ум-1 К-1 АВ-1	
PC-3	Classification of systems. Analysis Mendeleev's periodic table of elements.	Classification of systems. Analysis Mendeleev's periodic table of elements	Зн-1 Ум-1 К-1 АВ-1	
PC-4	The task of choosing the classification of drugs	The task of choosing the classification of drugs	Зн-1 Ум-1 К-1 АВ-1	
PC-5	Single-purpose decision-making	The concept and classification of one-target	Зн-1 Ум-2	

	models. Profit-cost and efficiency-cost models.	models, the principles of operation. The essence of the models "profit - cost" and "efficiency - cost", the basic principles.	К-1 АВ-1	
РС-6	Multi-purpose decision-making models. Method of analysis of hierarchies	the essence of the multi-purpose model, the main aspects of the method of analysis of hierarchies	Зн-1 Ум-2 К-1 АВ-1	
РС-7	Construction of models in some problems of queuing theory. The task of production planning.	basic structural elements of the system of service and construction of pharmacy order flow models, taking into account the hierarchy of priorities.	Зн-2 Ум-3 К-1 АВ-1	
РС-8	The theory of mass service. Construction of models in some problems of the theory of mass service.	The main structural elements of the service system and the construction of flow patterns of pharmacy orders, taking into account the hierarchy of priorities.	Зн-2 Ум-3 К-1 АВ-1	
РС-9	The task of planning production. Construction of flow pattern of a pharmacy orders.	basics of building service system models, problems of building models in systems analysis	Зн-2 Ум-3 К-1 АВ-1	
РС-10	Basics of decision making and situational modeling. Construction of models of the system of service in the stationary mode. Transport task, scheduling.	The basic concepts of decision making theories and situational modeling of systems. Review and classification of new information technology which most relevant for the analysis and modeling of systems, examples from the pharmaceutical industry.	Зн-2 Ум-3 К-1 АВ-1	
IW-1	History, subject, objectives of system analysis. Descriptions, basic structures and stages of system analysis.	The history of development and the subject of system analysis, system resources of society, the subject area of system analysis, system procedures and methods, system thinking. The basic notions of system analysis, system features, types of system topologies, various forms of description of systems, stages of system analysis.	Зн-1 Ум-1 К-1 АВ-2	

IW-2	The main directions of systems research.	areas of systems research, prerequisites and the need for a systems approach	Зн-1 Ум-1 К-1 АВ-2	
IW-3	Basic concepts of systems analysis.	basic concepts of systems analysis, principles of systems approach	Зн-1 Ум-1 К-1 АВ-2	
IW-4	Functioning and development of the system.	Different aspects of the concept of "information"	Зн-1 Ум-1 К-1 АВ-2	
IW-5	Classification of systems.	types and classes of information, methods and procedures for updating information, ways of entering the measure of measuring the amount of information, the relationship with the change of information in the system, examples.	Зн-1 Ум-1 К-1 АВ-2	
IW-6	Information, knowledge, system	Basic concepts of modeling of systems, system types and properties of models, life cycle of model	Зн-1 Ум -1 К-1 АВ-2	
IW-7	Principles of creation and management in information systems.	basic concepts of mathematical and computer modeling, computational experiment, operations of modeling.	Зн-2 Ум-3 К-1 АВ-2	
IW-8	Fundamentals of system simulation. Mathematical and computer modeling	The main structural elements of the service system and the construction of flow patterns of pharmacy orders, taking into account the hierarchy of priorities.	Зн-3 Зн-4 Ум-4 К-1 АВ-2	
IW-9	The theory of mass service.	The basic concepts of decision making theories and situational modeling of systems.	Зн-5 Ум-5 К-1 АВ-2	
IW-7	Basics of decision making and situational modeling. New technologies of systems analysis and design.	Review and classification of new information technology which most relevant for the analysis and modeling of systems, examples from the pharmaceutical industry.	Зн-1–5 Ум-1–5	
IW-14	Individual work.	Individual task.	Зн-6 Ум-5 Ум-6 К-1	

			AB-2	

The following *teaching methods are used during practical classes*: verbal methods (lecture, discussion); visual methods (illustration, demonstration, frontal experiment); practical methods (laboratory work and solving of problems with professional content); individual work of students with comprehension and learning of material; use of control and training computer software in the discipline; use of project method for interdisciplinary integration.

8. Verification of results

Scoring system

Current control is realized on the basis of the control of theoretical knowledge, skills and abilities. Forms of current control: oral survey (frontal, individual, combined survey), practical test of formed professional skills, test control (open and closed tests).

Individual work of students is evaluated on practical classes and is part of the final grade of the student. The final grade for the current educational activity is set on a 4-point (traditional) scale.

Criteria of evaluation

- ✓ grade 5/"excellent" – the student has mastered the theory flawlessly, demonstrates deep and comprehensive knowledge of the certain topic or academic discipline, the main theses of scientific papers and recommended literature, thinks logically and gives an answer, freely uses the acquired theoretical knowledge when analyzing practical material, expresses his attitude to certain problems, demonstrates a high level of mastery of practical skills;
- ✓ grade 4/"good" – the student has mastered the theoretical material well, knows the main aspects from primary sources and recommended literature, presents it in a reasoned way; has practical skills, expresses his thoughts on certain issues, but certain inaccuracies and errors are assumed in the logic of the presentation of theoretical content or in the performance of practical skills;
- ✓ grade 3/"satisfactory" – the student has basically mastered the theoretical knowledge of the topic or discipline, orients himself in primary sources and recommended literature, but answers unconvincingly, confuses concepts, additional questions cause the student uncertainty or lack of stable knowledge; when answering questions of a practical nature, reveals inaccuracies in knowledge, does not know how to evaluate facts and phenomena, relate them with future activities, makes mistakes when performing practical skills;
- ✓ grade 2/"unsatisfactory" – the student has not mastered the material of the topic (discipline), does not know scientific facts, definitions, hardly orients himself in primary sources and recommended literature, lacks scientific thinking, practical skills are not formed.

Scoring criteria:

4-point scale	Correct answers
«5»	90%-100%
«4»	70 - 89%
«3»	50 – 69%
«2»	less 50%

Code	Code	Verification	Criteria
ЗН-1 – ЗН-8, УМ-1 – УМ-8, К-1 – К-2 АВ-1 – АВ-3	L-1-5, PC-1-10, IW-1-14.	Test control on the MISA platform (10-15 test tasks with one correct answer); Oral survey and/or written control – theoretical questions (including questions on individual work) and tasks of medical and biological content	**Test control**: 50-69% – satisfactory; 70-89% – good; 90-100% – excellent. **Oral survey and/or written control:** evaluation according to evaluation criteria . **Practical skills / report**

		Practical skills / report on laboratory work.	**on laboratory work**: passed / failed
The final test			
General evaluation system	Participation on practical classes during the semester is 100% on a 200-point scale.		
Scales	Traditional 4-point scale, 200-points scale, ECTS		
The conditions of access to the differential test	The student attended all practical (laboratory) classes and received at least 120 points for current educational activity.		
Type of a final examination	**Verification**	**Criteria**	
Criteria of evaluation for the pass-fail test			
Pass-fail test	**Pass-fail test** is a form of the final control, which consists in assessing the student's mastery of educational material in the discipline on the basis of the average score of the results of current control and scores for individual control tasks in the final lesson. All topics submitted for current control must be included. Grades from a 4-point scale are converted into points on a multi-point (200-point) scale in accordance with the Regulation "Criteria, rules and procedures for evaluating the results of students' educational activities".		

The highest possible score points which a student can obtain for the current educational activity is 200 points.

Minimal number of score points which a student must obtain for current educational activity is 120 points.

Calculation of the points number is based on grades received by student by the traditional scale (by calculation of the arithmetic mean (AM) rounded to two decimal places). The resulting value is converted into points by multi-points scale as follows:

$$x = \frac{AM \times 200}{5}$$

For convenience, the table of recalculation on a 200-point scale is given:

Conversion of the average grade for current educational activity to the point scale for discipline which is finished with exam

4-бальна шкала	200-бальна шкала	4-бальна шкала	200-бальна шкала	4-бальна шкала	200-бальна шкала	4-бальна шкала	200-бальна шкала
5	200	4.45	178	3.92	157	3.37	135
4.97	199	4.42	177	3.89	156	3.35	134
4.95	198	4.4	176	3.87	155	3.32	133
4.92	197	4.37	175	3.84	154	3.3	132
4.9	196	4.35	174	3.82	153	3.27	131
4.87	195	4.32	173	3.79	152	3.25	130
4.85	194	4.3	172	3.77	151	3.22	129
4.82	193	4.27	171	3.74	150	3.2	128
4.8	192	4.24	170	3.72	149	3.17	127
4.77	191	4.22	169	3.7	148	3.15	126
4.75	190	4.19	168	3.67	147	3.12	125
4.72	189	4.17	167	3.65	146	3.1	124
4.7	188	4.14	166	3.62	145	3.07	123

4.67	187	4.12	165	3.57	143	3.02	121
4.65	186	4.09	164	3.55	142	3	120
4.62	185	4.07	163	3.52	141	Менше 3	Недостатньо
4.6	184	4.04	162	3.5	140		
4.57	183	4.02	161	3.47	139		
4.52	181	3.99	160	3.45	138		
4.5	180	3.97	159	3.42	137		
4.47	179	3.94	158	3.4	136		

Students obtain a semester credit if the average grade for current academic activity during the semester is at least "3" (120 points on a 200-point scale).

Points on discipline are converted regardless both in ECTS scale and a 4-point scale. Scores of ECTS scale can not be converted into 4-point scale and vice versa. Scores of students taking into account the number of points on the discipline are ranked on a ECTS scale so that:

Grade in ECTS	**Statistical index**
A	Top 10% of students
B	The next 25% of students
C	The next 30% of students
D	The next 25% of students
E	The last 10% of students

Ranking with assigning grades of “A”, “B”, “C”, “D”, “E” is held for the students of one course, studying one specialty and successfully completed the academic discipline. Students who have received grades FX, F (“2”) are not recorded to the list of students for ranking. Students who have received grade FX after repassing automatically get grade “E”.

For students who completed the program successfully the points on discipline are converted into a traditional 4-point scale by absolute criteria, which are listed in the table below:

Points on discipline	**Grade in 4-point scale**
From170 to 200 points	5
From 140 to 169 points	4
From 122 to 139 points	3
Lower than minimum number of points that a student must score	2

9. Course policy

Student attendance is required.

The missed practical class are making up according to an appropriate schedule agreed on the department.

The policy of academic integrity.

Use any material or aid (including cell phone etc) during the period of test/exam is prohibited.

The policy of academic discipline is based on the principles of academic integrity. The student is obliged to fully master the knowledge, skills, practical skills and competencies of this discipline.

Policy on compliance with the principles of academic integrity of students of higher education:

- ✓ individual performance of educational tasks of current and final controls without using external sources of information, except for cases permitted by the teacher;
- ✓ cheating during control is prohibited (including using mobile devices).

Educational policy:

- ✓ attendance at all classes is mandatory for the purpose of current and final assessment of knowledge (except for respectable reason);
- ✓ missed classes are reworked according to the approved schedule;
- ✓ repass the topic for which the student received a negative grade is carried out at a time convenient for the teacher and the student;
- ✓ it is not allowed to repass the topic in order to impove the grade during the current and final control.

10 Books

1. Betty Kirkwood, Jonathan Sterne. Essential Medical Statistics. Blackwell Science, 2nd edition, 2003. – 512 p.
2. Dieter Imboden, Stefan Pfenninger Introduction to Systems Analysis. Mathe-matically Modeling Natural Systems. Springer-Verlag Berlin, 2013. – 226 p.
3. Zdzislaw Bubnicki. Analysis and Decision Making in Uncertain Systems. Springer-Verlag London, 2004. – 362 p.
4. Mykel J. Kochenderfer Decision Making Under Uncertainty: Theory and Application. MIT Lincoln Laboratory Series, 1st Edition. – 317 p.
5. Les yoe CharPrinciples of Risk Analysis: Decision Making Under Uncertainty, The Amazon Book Review, 1st Edition. – 220 p.
6. Jeffrey Whitten, Lonnie Bentley Introduction to Systems Analysis & Design. McGraw-Hill/Irwin, 1st Edition, 2006. – 640 p.

11. Equipment, and software of the discipline / subject

- ✓ academic program of the discipline;
- ✓ lecture notes on discipline (thesis);
- ✓ lecture presentations;
- ✓ guidelines for lecturers/instructors;
- ✓ guidelines for practical classes for students;
- ✓ guidelines for individual students' work;
- ✓ test and control tasks for practical classes;
- ✓ questions and tasks for the final control (exam).

12. Additional information

Curriculum coordinator – Oksana Malanchuk, PhD, Associate Professor, oksana.malan@gmail.com
Responsible for students' science club of department – Marianna Paykush, Dr.Sci., Associate Professor, marianna.gron@gmail.com

Web page of the department: https://new.meduniv.lviv.ua/en/kafedry/kafedra-biofizyky/

Responsible for Syllabus
Oksana Malanchuk, PhD, Associate Professor _____

Head of the Department
Roman Fafula, Dr.Sci., Professor _____