MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
Lesya Ukrainka Volyn National University
Faculty of Information Technologies and Mathematics
Department of Computer Science and Cybersecurity

SYLLABUS

Normative Educational Component

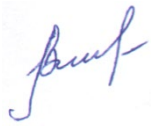
METHODOLOGY AND ORGANIZATION OF SCIENTIFIC RESEARCH IN THE FIELD OF COMPUTER SCIENCES

Preparations at the Second (Master's) Level of Higher Education
Specialty: 122 Computer Science
Educational (Professional) Program: Computer Science and Information Technologies

Lutsk – 2023

Syllabus of the educational component «Methodology and Organization of Scientific Research in The Field of Computer Sciences» for Master's level training, field of knowledge 12 Information Technology, specialization 122 Computer Science, within the educational program Computer Science and Information Technology.

Developer: Ia.M. Pasternak, Professor of the Department of Computer Science and Cybersecurity, DSc, Prof.

Approved by
Program Educational Guarantor:  Bulatetskyy V.V.

The syllabus of the educational component was approved at the meeting of the Department of Computer Science and Cybersecurity

protocol №. 1 of 30.08.2023

Head of the department:  (Hryshanovych T.O.)

I. Description of the educational component

<table>
<tr><td>Name of indicators</td><td>Field of knowledge, specialty, educational-professional /educational-scientific/educational-creative program, educational level</td><td>Characteristic educational component</td></tr>
<tr><td>Full-time form of education</td><td rowspan="6">12 Information Technologies, 122 Computer Science, Computer Science and Information Technology, second (master's)</td><td>Normative</td></tr>
<tr><td rowspan="2">Number of hours/credits 150/5</td><td>Year of study – 1st</td></tr>
<tr><td>Semester – 1st</td></tr>
<tr><td rowspan="3">IERT: no</td><td>Lectures – 16 hours</td></tr>
<tr><td>Laboratory – 20 hours</td></tr>
<tr><td>Independent work – 104 hours</td></tr>
<tr><td colspan="2">Language of education – English, Ukrainian</td><td>Consultations – 10 hours
Form of control: exam</td></tr>
</table>

II. Information about the instructor

PIP: Pasternak Iaroslav Mykhailovych
Degree: DSc
Academic status: Professor
Position: professor of the Department of Computer Science and Cybersecurity
Contact Information: Iaroslav.Pasternak@vnu.edu.ua
Days of classes: http://94.130.69.82/cgi-bin/timetable.cgi

III. Description of the educational component

1. **Abstract of the course**
   The course concerns the teaching of the fundamentals of the methodology of scientific research and cognition, the specifics of planning scientific research, conducting research, systematizing, analyzing, and synthesizing scientific information, principles of creating new scientific knowledge, and presenting the results of scientific research.

2. **Prerequisite (*previous courses on which the study of the educational component is based*)**
   Bachelor's level of higher education.

3. **The purpose and tasks of the educational component**
   Development of competences in mastering the methodology and methods of scientific research, forming a system of knowledge about scientific criteria and requirements for the organization and argumentation of research, analysis of its results.

4. **Learning outcomes (Competencies)**
   Learning outcomes:

LO01. Have specialized conceptual knowledge that includes modern scientific achievements in the field of computer science and is the basis for original thinking and conducting research, critical thinking of problems in the field of computer science and at the border of the fields of knowledge.

LO02. Have specialized computer science problem-solving skills necessary for conducting research and/or conducting innovative activities to develop new knowledge and procedures.

LO16. Conduct research in the field of computer science.

LO19. To analyze the current state and global trends in the development of computer sciences and information technologies.

Competencies:

General competences

GC01. Ability to abstract thinking, analysis and synthesis.

GC02. Ability to apply knowledge in practical situations.

GC04. Ability to communicate in a foreign language.

GC05. Ability to learn and master modern knowledge.

GC06. The ability to be critical and self-critical.

GC07. Ability to generate new ideas (creativity).

Special (professional) competences

SC01. Understanding the theoretical foundations of computer science.

SC02. The ability to formalize the subject area of a certain project in the form of an appropriate information model.

SC03. Ability to use mathematical methods to analyze formalized models of the subject area.

SC10. The ability to assess and ensure the quality of IT projects, information and computer systems of various purposes, to apply international standards for assessing the quality of software of information and computer systems, models for assessing the maturity of information and computer systems development processes.

SC11. Ability to initiate, plan and implement the development processes of information and computer systems and software, including its development, analysis, testing, system integration, implementation and support.

5. **The structure of the educational component**

Content module 1. Science. Scientific knowledge. Innovations

Content module 2. Scientific work. Research activity

Names of content modules and topics	Total	Lec.	Lab.	IW	Cons.	Control form/ Points
Content module 1. Science. Scientific knowledge. Innovations						
Topic 1. Concept of science. Definition and tasks of science. Science and its purpose. Concept of paradigm. Scientific knowledge.	15	2	2	11	1	DS, SP/C 4
Topic 2. Types of knowledge. Scientific and non-scientific knowledge. Criteria of scientific knowledge. Gödel's theorem and scientific knowledge in natural and computer sciences.	15	2	2	11	1	DS, SP/C 4
Topic 3. The main stages of the development of science. Patterns and trends in the development of science. Problems of world and Ukrainian science.	15	2	2	10	1	DS, SP/C 4

Topic 4. Innovative activity in the field of science. The concept of innovation. Innovative activity and technology transfer. Technological platforms. Technoparks. Business incubators. The issue of motivation and incentives in innovation.	15	2	2	10	1	DS, SP/C 4
Topic 5. Modern organizational forms of scientific activity. Training of scientific personnel. Law of Ukraine "On scientific and scientific and technical activity".	15	2	0	10	1	DS, SP/C 4
Module 1 Total	75	10	8	52	5	20
Content module 2. Scientific work. Research activity						
Topic 6. General methodology of scientific work. Collection, systematization and generalization of facts. Working hypothesis. Methods of scientific research and their classification.	15	2	2	10	1	DS, SP/C 4
Topic 7. Science as an information system. Main types and sources of scientific information. Criteria for evaluating the level of scientific works.	15	2	2	10	1	DS, SP/C 4
Topic 8. Information provision of scientific research. Content and forms of information provision of scientific research. System of bodies of scientific and technical information of Ukraine. Intellectual Property.	15	2	2	10	1	DS, SP/C 4
Topic 9. Search for scientific information. Libraries. Reference journals. Card files and electronic libraries abroad.	15	2	2	11	1	DS, SP/C 4
Topic 10. Types of scientific activity. Classification of research works. Stages of research work. Implementation. Principles of the implementation of the SRW. Preparation of a report on the SRW. Publication of the results of the SRW.	15	2	0	11	1	DS, SP/C 4
Module 2 Total	75	10	8	52	5	20
Types of final works						Points
Modular control work 1						30
Modular control work 2						30
IERT (*in the presence*)						
Other (*to indicate*)						
Total hours/Points	150	20	16	104	10	100

Control methods*: DS – discussion, SP/C – solving problems/cases, IERT – individual task, MCW – modular control work.

6. **Tasks for independent study**

1. The concept of science, its role in the development of society.
2. Goals and tasks of scientific research.
3. Experimental studies.
4. Structure and classification of science.
5. Object and subject of research.
6. Expert research method.

7. Scientific research: concepts, types and forms of organization.
8. Sources of information for scientific research.
9. Plan of scientific research.
10. Training of scientific personnel.
11. The main departments of the library.
12. Prospective research plan.
13. Forms and methods of working with information sources.
14. Research work plan.

IV. Evaluation policy

Instructor's Policy Regarding the Student's Education. Education seekers must attend practical sessions and submit corresponding assignments in a timely manner. The evaluation of work is done considering the correctly completed volume in proportion to the score defined by this syllabus, rounded up.

Academic Integrity Policy. Higher education seekers are allowed to study any information sources related to the task topics, as well as consult and work with their course colleagues in groups. However, tasks must be completed independently. Otherwise, the corresponding scores for the higher education seeker will not be counted.

Policy on Sentences and Resubmissions. Tasks must be completed within the allocated time. Late submissions will result in a 10% reduction in the corresponding evaluation score.

Assessment of the educational achievements of education seekers is carried out during ongoing monitoring of the results of performing the types of work provided by the syllabus of the educational component. (According to the Regulation on Current and Final Assessment of Knowledge of Education Seekers of Lesya Ukrainka Volyn National University).

The assessment is conducted on a 100-point scale. The grade includes ongoing assessment (evaluated based on work in class, timely and high-quality completion of homework, independent solving of individual tasks) and final modular assessment (written modular control works). The maximum number of points a student can earn during the semester's ongoing evaluation, along with the points for completing an individual task, is 40 points. The final modular assessment for the semester includes grades for all modular control works (MCWs). The maximum number of points a student can earn during modular control for the semester is 60 points.

If at least 75 points are accumulated by the end of the semester, and the higher education seeker agrees with this result, the grade for the semester may be issued without taking an exam. Otherwise, the student takes an exam; the maximum number of points that can be obtained on the exam is 60 points. They replace the scores of the modular semester control, while the ongoing semester control is retained. The exam is conducted in an oral form. The grade for the semester in case of passing the exam is the sum of the ongoing control scores, independent work, and the points obtained during the exam.

V. Final control

The exam includes basic questions, typical and complex problems, situations, tasks that require a creative answer and the ability to synthesize the acquired knowledge and apply it when solving practical problems.

The exam is conducted orally. The following questions are presented for the exam.

The questions and form of the exam are defined in this syllabus.

Exam questions:

1. Concept of science.
2. Definition and tasks of science.
3. Science and its purpose.

4. Concept of paradigm.
5. Scientific knowledge.
6. Types of knowledge.
7. Scientific and non-scientific knowledge.
8. Criteria of scientific knowledge.
9. Godel's theorem and scientific knowledge in natural and computer sciences.
10. The main stages of the development of science.
11. Patterns and trends in the development of science.
12. Problems of world and Ukrainian science.
13. The concept of innovation.
14. Innovative activity and technology transfer.
15. Technological platforms.
16. Technoparks.
17. Business incubators.
18. The issue of motivation and incentives in innovation.
19. Modern organizational forms of scientific activity.
20. General methodology of scientific work.
21. Collection, systematization and generalization of facts.
22. Working hypothesis.
23. Methods of scientific research and their classification.
24. Main types and sources of scientific information.
25. Criteria for evaluating the level of scientific works.
26. Content and forms of information provision of scientific research.
27. System of bodies of scientific and technical information of Ukraine.
28. Intellectual Property.
29. Search for scientific information. Libraries.
30. Reference journals.
31. Card files and electronic libraries abroad.
32. Types of scientific activity.
33. Classification of research works.
34. Stages of research work.
35. Implementation.
36. Principles of the implementation of the NDR.
37. Preparation of a report on the GDR.
38. Publication of the results of the GDR.
39. Training of scientific personnel.
40. Law of Ukraine "On scientific and scientific and technical activity".

Examples of exam tasks and cases

1. Based on your preferences and skills, formulate a topic that you would like to choose for your qualifying research in the field of computer science. Justify its relevance and importance for society, the economy or the IT industry. Give reasons for choosing this particular topic.
2. Work on 2-3 scientific articles in the field of computer science provided by the teacher. Underline the main findings of each paper and explain the relationship between them and their sequence.

3. Process the scientific article provided by the teacher, carry out its scientific review and give a reasoned answer about the feasibility of choosing specific research methods (data analysis, experimental research, modeling, etc.).
4. Work through a research paper provided by the instructor, consider possible ethical aspects, in particular, related to confidentiality, privacy and possible negative consequences. Suggest ways to minimize risks.
5. Work on the scientific article provided by the teacher. Conduct an analysis of the obtained research results. Explain how these results support or refute the thesis. Are the results fully covered? What results do you think could be added?
6. Work on the scientific article provided by the teacher. Analyze the methodology the authors used in their research. Draw conclusions about its effectiveness and possible limitations.
7. Prepare a short presentation of the scientific article provided by the teacher, in which you would present the main achievements of this research to non-specialists.

VI. Rating scale

A scale for evaluating the knowledge of education seekers from educational components, where the form of control is an exam

Rating in points	Linguistic assessment	Evaluation on the ECTS scale	
		rating	explanation
90–100	Perfect	A	excellent performance
82–89	Very good	B	above average level
75–81	Good	C	overall good job
67–74	Satisfactorily	D	not bad
60–66	Enough	E	performance meets the minimum criteria
1–59	Unsatisfactorily	Fx	Recompletion is required

VI. Recommended literature and Internet resources

1. Пастернак Я.М. Методологія та організація наукових досліджень в галузі комп'ютерних наук. Електронний курс освітнього компонента. Рекомендовано засіданням НМР ВНУ ім. Лесі Українки, протокол № 10 від 21.06.2023. Режим доступу: https://moodle-cs.vnu.edu.ua/course/view.php?id=147
2. Бобилєв В. П. Методологія та організація наукових досліджень [Текст] : підручник / Бобилєв В. П., Іванов І. І., Пройдак Ю. С. ; Нац. металург. акад. України. Дніпропетровськ: ІМА-пресс, 2014. – 643 с.
3. Бірта Г.О., Бургу Ю.Г. Методологія і організація наукових досліджень. [текст] : навч. посіб. К. : «Центр учбової літератури», 2014. 142 с.
4. Зацерковний В.І., Тішаєв І.В., Демидов В.К. Методологія наукових досліджень : навч. посіб. Ніжин : НДУ ім. М. Гоголя, 2017. 236 с.
5. Клименюк О. В. Технологія наукового дослідження : підручник. К.-Ніжин: Аспек-Поліграф, 2006. 308 с.
6. Колесников О. В. Основи наукових досліджень: навч. посіб. – 2-ге вид. випр. та доп. К.: Центр учбової літератури, 2011. 144 с.
7. Крушельницька О. В. Методологія та організація наукових досліджень: навч. посіб.: реком. МОН України для ВНЗ. К.: Кондор, 2009. 206 с.
8. Петрук В.Г., Володарський Є.Т., Мокін В.Б. Основи науково-дослідної роботи: навч. посіб. для студ. ВНЗ. Вінниця: Універсум-Вінниця, 2006. 144 с.
9. Kumar U., Dubey B., Kothari D. P.Research Methodology: Techniques and Trends. CRC Press, 2022.
10. Thomas C.G. Research Methodology And Scientific Writing. Springer, 2021.