Modernization of Pedagogical Higher Education by Innovative Teaching Instruments

Co-funded by the Erasmus+ Programme of the European Union

MoPED: Modernization of Pedagogical Higher Education by Innovative Teaching Instruments

586098-EPP-1-2017-1-UA-EPPKA2-CBHE-JP

HANDBOOK

TITLE OF THE COURSE:

Educational Robotics

SPECIALITY - "*014 Secondary education (Informatics)*"

HIGHER EDUCATION DEGREE: *Bachelor*

Developer: Dr. Prof. T. Mazurok, V. Korablov, PhD V. Chernykh

Higher Education Institution: Ushynsky University

Faculty: Physical and Mathematical

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Course abstract: (up to 200-250 words)

This discipline is mandatory for undergraduate students in computer science in the second year (third semester). Within the framework of this discipline students study the basic concepts and history of robotics, technical design, hardware programming of microcontrollers, study the methodological foundations of teaching robotics in high school. The peculiarities of this course are the direction of development of robotic systems for their further use as teaching aids in the school course of computer science.

Upon successful completion of their studies, students receive integrated, basic and special competencies that allow them to solve applied problems using robotic systems, conduct robotics classes in high school using innovative pedagogical technologies in the eco-system ICR (Innovation Classroom).

Key concepts: microcontrollers, hardware programming, robotic teaching aids, computer science teaching methods, innovative learning technologies.

CONTENT

1. Description of the discipline

1.1. The volume of discipline in ECTS credits and its distribution in hours by forms of organization of the educational process and types of training sessions

4.0 ECTS credits.

Total number of hours: 120

For full-time study: 10 lecture hours, 30 hours of laboratory classes; 80 hours - independent work of students ;.

For distance learning: 4 lecture hours; 8 hours of laboratory classes; 108 hours - independent work of students.

1.2. Characteristics of the discipline by form of study

Students are taught full-time and part-time forms of study during the study of the discipline, in particular with the use of blended learning technology.

1.3. Discipline status

Discipline is a mandatory component of the educational program

1.4. Prerequisites for studying the discipline

Missing

1.5. Year of preparation, semester

Year of preparation - 2, semester - 4

1.6. Form of final control

Test

1.7. Language of instruction

English

1.8. Internet address of the permanent placement of educational content of the discipline.

https://pdpu.edu.ua/

1.9. Developers

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Korablyov Vyacheslav Anatoliyovych, Senior Lecturer at the Department of Applied Mathematics and Informatics

Chernykh Volodymyr Volodymyrovych, Ph.D., Lecturer at the Department of Applied Mathematics and Informatics.

1.10. The purpose of studying the discipline

To acquaint future teachers of informatics with the basics of functioning, design and development of hardware and software robotic complexes, to ensure the ability of future teachers of informatics to use such complexes as teaching aids in school courses of informatics and robotics.

1.11. Competences that are formed in the process of studying the discipline

Integral competence (IC). Ability to solve complex specialized problems and practical problems in the field of secondary education, which involves the use of theories and methods of pedagogy, computer science, English, and is characterized by complexity and uncertainty of pedagogical conditions of the educational process of secondary school

General competencies (GQ):

LC 2. Ability to apply the acquired knowledge in practical situations.

Special competencies (SC):

SC 1. Knowledge and understanding of the subject area and understanding of professional activity

SC 2. Ability to use subject knowledge in the educational process
SC 6. Ability to select and apply appropriate forms, methods, technologies and teaching aids
SC 13.Ability to use information and communication technologies

1.12. Learning outcomes of the discipline

PR 1. Demonstrate knowledge and understanding of the basics of computer science, English language and literature

PR 2.Know the basic psychological and pedagogical theories of learning, learning technologies, current issues of pedagogy and methods of teaching computer science, English language and literature

PR 5.Know the basics of life safety, safe use of computer science equipment, language classrooms

PR 6.Be able to find, process and analyze information from various sources, primarily through information technology

PR 12. Use knowledge of foreign languages at a level that allows to obtain and evaluate information in the field of professional activity from foreign sources

PR 14. Be responsible for ensuring the protection of life and health of students in educational and extracurricular activities

1.13. Control of students' academic achievements

<table>
<tr><td>Learning outcomes diagnostic tools (current and final assessment)</td><td>Assessment for each content module includes points for the results of student learning in practical classes, as well as during independent work</td></tr>
<tr><td>Final evaluation</td><td>The final assessment in the form of a test is carried out according to the assessment of the obtained learning outcomes of students during the course and has the following weights:
Content module 1– max 50 points (2 ECTS credits)
Content module 2 - max 50 points (2 ECTS credits)
Total: max 100 points</td></tr>
<tr><td>Communication and feedback</td><td>Students receive information about learning outcomes (grades, comments) in the Google Classroom grade journal.

Students can ask questions and get advice in person and remotely via corporate email, online messengers, and webinars.</td></tr>
<tr><td>Free assessment scale</td><td>
<table>
<tr><td colspan="3">For credit</td></tr>
<tr><td>90 - 100</td><td>A</td><td rowspan="5">"Credited</td></tr>
<tr><td>82 - 89</td><td>B</td></tr>
<tr><td>74 - 81</td><td>C</td></tr>
<tr><td>64 - 73</td><td>D</td></tr>
<tr><td>60 - 63</td><td>E</td></tr>
<tr><td>35 - 59</td><td>FX</td><td rowspan="2">"Not credited"</td></tr>
<tr><td>1 - 34</td><td>F</td></tr>
</table>
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2.Content and structure of the discipline

2.1. Content module 1. **FUNDAMENTALS OF HARDWARE ARCHITECTURE OF ROBOTIC SYSTEMS**

2.1.1. TOPIC 1. Basic concepts, terms, main trends in the development and application of robotic systems

2.1.2. Purpose and expected results.

Goal: to form students-future teachers of computer science ideas about modern robotic systems, knowledge of basic concepts and terms of robotics, the main stages of development of robotics as a science, the ability to determine the application of basic classes of robotic systems to solve applied practical problems.

Expected results:

knowledge of the main stages of formation and development of robotics, conscious determination of the most appropriate robotic means for solving applied practical problems, the ability to justify their choice.

2.1.3. Criteria and forms of evaluation of learning outcomes on the topic.

Forms of evaluation: formative evaluation of messages, essays, presentations of the completed project on the topic

Evaluation criteria	*Quantitative and / or qualitative characteristics*
knowledge of basic concepts and terms of robotics, the main stages, the main directions of development and application of the main classifs of robotic systems.	*High level*: the student has a systematic, reasoned, deep knowledge of educational material, is able to independently assess some new facts and phenomena, uses a variety of sources of information *Sufficient level*: the student possesses the educational material at a sufficient level, reasonably states its main content during the answers, but without a comprehensive analysis and argumentation.

	Average: the student partially owns the study material, but shows basic knowledge. During the answers he teaches the educational material in fragments, superficially, insufficiently reveals the content of theoretical questions and practical tasks. *Initial level*: the student partially or insufficiently owns the educational material, operates with initial ideas during the answers, insufficiently reveals the content of theoretical questions, admits inaccuracies and errors.
Ability to independently choose the class of robotic system to solve an applied practical problem, justify their choice, present their views.	*High level*(20 points) The developed presentation is thorough, corresponds to the modern level of development of robotics. The student is fluent in terminology. A variety of technological tools are adequately used. The presented information is scientific, meets the program requirements. No errors. *Sufficient level* (16 points) The developed presentation is made completely with observance of modern technologies. The expediency of choosing a robotic system is partially justified. The presented information is scientific, meets the program requirements. There are minor flaws in the information provided. *Average* (10 points) The developed presentation is made mainly with observance of modern technologies. The expediency of choosing the class of robotic system is insufficiently substantiated. The information provided is scientific, but sometimes the software requirements are not met. There are no more than two errors in the presented information.

	Low level (4 points) In the developed presentation there are significant flaws in the observance of modern technologies. The expediency of choosing the class of robotic system is insufficiently substantiated. The information provided is scientific, but the program requirements are not met. In the presented informationthere are more than two errors.

2.1.4. Digital tools. Tools for working in a network environment, with electronic documents; with mobile learning devices; with visualization tools.

2.1.5. Innovative learning technologies. Technologies for the development of critical thinking, problem-oriented learning, blended learning, distance learning technologies.

2.1.6. Lecture 1.Basic concepts, terms, main trends in the development and application of robotic systems (1:00)

Plan:

1. Robotics: historical aspect.

2. Robotics: a typical structure of a generalized typical robotic system. Conceptual apparatus.

3. Classification of robotic systems.

4. Examples of the use of basic classes of robotic systems.

2.1.7. Task for independent work of students.

2.1.8. Laboratory lesson 1.1. Study of the basics and basic tasks of robotics. Demonstration of existing robot models. (2 hours)

2.1.9. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using different classes of robotic systems to solve applied problems (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.10. Tasks for independent work of students.

1. Prepare a presentation justifying the choice of class of robotic system for the proposed practical application problem.

Methodical materials and instructions.

The synopsis of the lecture №1 is available at the link https://moped.pdpu.edu.ua/

Lecture presentation лe1 is available at link https://moped.pdpu.edu.ua/

2.1.11. Laboratory lesson 1.2. Arduino IDE programming environment.

2.1.12 Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using Arduino IDE environment (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.13. Tasks for independent work of students.

Prepare a presentation about Arduino IDE environment.

2.1.14. Laboratory lesson 1.3. Fritzing development environment

2.1.15 Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using Fritzing development environment (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.16. Tasks for independent work of students.

Prepare a presentation about Fritzing development environment.

2.1.17. Laboratory lesson 1.4. Arduino and analog sensors

2.1.18 Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using analog sensors (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.19. Tasks for independent work of students.

Prepare a presentation about analog sensors.

2.1.20. Laboratory lesson 1.5. Arduino and digital sensors

2.1.21 Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using digital sensors (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.22. Tasks for independent work of students.

Prepare a presentation about digital sensors.

2.1.23. TOPIC 2. USE OF ARDUINO AS A CONTROLLER OF EXECUTIVE DEVICES.

2.1.24. Purpose and expected results.

Goal: to form students-future teachers of computer science ideas about modern robotic systems, knowledge of basic concepts and terms of Arduino as a controller of executive devices.

Expected results:

knowledge of the main stages of using Arduino as a controller of executive devices.

2.1.25. Criteria and forms of evaluation of learning outcomes on the topic.

Forms of evaluation: formative evaluation of messages, essays, presentations of the completed project on the topic

Evaluation criteria	*Quantitative and / or qualitative characteristics*
knowledge of basic concepts and terms of robotics, the main stages, the main directions of development and application of the main classifs of robotic systems.	*High level*: the student has a systematic, reasoned, deep knowledge of educational material, is able to independently assess some new facts and phenomena, uses a variety of sources of information *Sufficient level*: the student possesses the educational material at a sufficient level, reasonably states its main content during the

	answers, but without a comprehensive analysis and argumentation. *Average*: the student partially owns the study material, but shows basic knowledge. During the answers he teaches the educational material in fragments, superficially, insufficiently reveals the content of theoretical questions and practical tasks. *Initial level*: the student partially or insufficiently owns the educational material, operates with initial ideas during the answers, insufficiently reveals the content of theoretical questions, admits inaccuracies and errors.
Ability to independently choose the class of robotic system to solve an applied practical problem, justify their choice, present their views.	*High level*(20 points) The developed presentation is thorough, corresponds to the modern level of development of robotics. The student is fluent in terminology. A variety of technological tools are adequately used. The presented information is scientific, meets the program requirements. No errors. *Sufficient level* (16 points) The developed presentation is made completely with observance of modern technologies. The expediency of choosing a robotic system is partially justified. The presented information is scientific, meets the program requirements. There are minor flaws in the information provided. *Average* (10 points) The developed presentation is made mainly with observance of modern technologies. The expediency of choosing the class of robotic system is insufficiently substantiated. The information provided is scientific, but sometimes the software requirements are not met. There are no more than two errors in the presented information. *Low level* (4 points) In the developed presentation there are significant flaws in the observance of modern technologies. The expediency of choosing the class of robotic system is insufficiently substantiated. The information provided is scientific, but the program requirements are not met. In the presented informationthere are more than two errors.

2.1.26. Digital tools. Tools for working in a network environment, with electronic documents; with mobile learning devices; with visualization tools.

2.1.27. Innovative learning technologies. Technologies for the development of critical thinking, problem-oriented learning, blended learning, distance learning technologies.

2.1.28. Lecture 2-3. Principles of Arduino control as an actuator controller

Plan:

1. Robotics: historical aspect.

2. Robotics: a typical structure of a generalized typical robotic system. Conceptual apparatus.

3. Classification of robotic systems.

4. Examples of the use of basic classes of robotic systems.

2.1.29. Task for independent work of students.

2.1.30. Laboratory lesson 2.1. Arduino and electromagnetic relay.

2.1.31 Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using Arduino and electromagnetic relay (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.32. Tasks for independent work of students.

Prepare a presentation about Arduino and electromagnetic relay.

2.1.33. Laboratory lesson 2.2. Arduino and solid state relay.

2.1.34. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using Arduino and solid state relay (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.35. Tasks for independent work of students.

Prepare a presentation about Arduino and solid state relay.

2.1.36. Laboratory lesson 2.3. Connecting the dimmer to the Arduino.

2.1.37. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of connecting Arduino to dimmer (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.38. Tasks for independent work of students.

Prepare a presentation about connecting dimmer to Arduino.

2.1.39. Laboratory lesson 2.4. Principles of servo control.

2.1.40. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of principles of servo control (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.41. Tasks for independent work of students.

Prepare a presentation about Principles of servo control.

2.1.42. Laboratory lesson 2.5. Arduino and I2C devices.

2.1.43. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of Arduino and I2C devices (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.44. Tasks for independent work of students.

Prepare a presentation about Arduini and I2C devices.

2.1.45. Laboratory lesson 2.6. Arduino and Wire Library.

2.1.46. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of Arduino and Wire Library (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.47. Tasks for independent work of students.

Prepare a presentation about Arduino and Wire Library.

2.1.48. Laboratory lesson 2.7. Arduino and real-time clock on the I2C bus.

2.1.49. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of Arduino and real-time clock on the I2C bus (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.1.50. Tasks for independent work of students.

Prepare a presentation about Arduino and real-time clock on the I2C bus.

CONTENT MODULE 2. Server for data collection from Ethernet sensor modules installed on the Arduino. Raspberry Pi microcomputer

2.2.1. TOPIC 3. Northern sensor module on Arduino, data collection server on Raspberry Pi microcomputer

2.2.2. Purpose and expected results.

Goal: to form students-future teachers of computer science ideas about modern robotic systems, knowledge of basic concepts and terms of Raspbery Pi microcomputer.

Expected results:

knowledge of the main stages of using Raspbery Pi microcomputer.

2.2.3. Criteria and forms of evaluation of learning outcomes on the topic.

Forms of evaluation: formative evaluation of messages, essays, presentations of the completed project on the topic.

Evaluation criteria	*Quantitative and / or qualitative characteristics*
knowledge of basic concepts and terms of robotics, the main stages, the main directions of development and application of Raspbery Pi microcomputer.	*High level*: the student has a systematic, reasoned, deep knowledge of educational material, is able to independently assess some new facts and phenomena, uses a variety of sources of information *Sufficient level*: the student possesses the educational material at a sufficient level, reasonably states its main content during the answers, but without a comprehensive analysis and argumentation. *Average*: the student partially owns the study material, but shows basic knowledge. During the answers he teaches the educational material in fragments, superficially, insufficiently reveals the content of theoretical questions and practical tasks. *Initial level*: the student partially or insufficiently owns the educational material, operates with initial ideas during the answers, insufficiently reveals the content of theoretical questions, admits inaccuracies and errors.
Ability to independently choose the class of robotic system to solve an applied practical problem, justify their choice, present their views.	*High level*(20 points) The developed presentation is thorough, corresponds to the modern level of development of robotics. The student is fluent in terminology. A variety of technological tools are adequately used. The presented information is

	scientific, meets the program requirements. No errors. *Sufficient level* (16 points) The developed presentation is made completely with observance of modern technologies. The expediency of choosing a robotic system is partially justified. The presented information is scientific, meets the program requirements. There are minor flaws in the information provided. *Average* (10 points) The developed presentation is made mainly with observance of modern technologies. The expediency of choosing the class of robotic system is insufficiently substantiated. The information provided is scientific, but sometimes the software requirements are not met. There are no more than two errors in the presented information. *Low level* (4 points) In the developed presentation there are significant flaws in the observance of modern technologies. The expediency of choosing the class of robotic system is insufficiently substantiated. The information provided is scientific, but the program requirements are not met. In the presented informationthere are more than two errors.

2.2.4. Digital tools. Tools for working in a network environment, with electronic documents; with mobile learning devices; with visualization tools.

2.2.5. Innovative learning technologies. Technologies for the development of critical thinking, problem-oriented learning, blended learning, distance learning technologies.

2.2.6. Lecture 3. Technical characteristics and possibilities of Raspberry Pi

2.2.7. Task for independent work of students.

2.2.8. Laboratory lesson 3.1. Data exchange via GPRS / GSM Shield card

2.2.9. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of Data exchange via GPRS / GSM Shield card (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.2.10. Tasks for independent work of students.

Prepare a presentation about the advantages and disadvantages of Data exchange via GPRS / GSM Shield card.

2.2.11. Laboratory lesson 3.2. Control from the tablet with executive devices connected to the Arduino.

2.2.12. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of control from the tablet with executive devices connected to the Arduino (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.2.13. Tasks for independent work of students.

Prepare a presentation about control from the tablet with executive devices connected to the Arduino.

2.2.14. Laboratory lesson 3.3. GPIO interface

2.2.15. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of GPIO interface (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.2.16. Tasks for independent work of students.

Prepare a presentation about GPIO interface.

2.2.17. Laboratory lesson 3.4. WebIOPi- web interface and cloud for Raspberry Pi.

2.2.18. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of WebIOPi- web interface and cloud for Raspberry Pi (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.2.19. Tasks for independent work of students.

Prepare a presentation about WebIOPi- web interface and cloud for Raspberry Pi.

MODULE 2. METHODS OF TRAINING AND USE OF ROBOTIC TRAINING COMPLEXES

2.3. Content module 3. Methods of using robotic devices in teaching algorithmization and modeling in the school course of computer science (5-9 grades).

2.3.1. TOPIC 1. Features of the use of robotic devices in teaching algorithmization

2.3.2. Purpose and expected results.

Goal: to form in students-future teachers of computer science ideas about the existing methodical system of teaching algorithmization, the role of robotic complexes as a means of learning.

Expected results:

knowledge of the concept of the performer of the algorithm, the advantages and didactic expediency of the use of robotic devices as performers in the process of forming algorithmic thinking in the school course of computer science;

ability to choose and use robotic devices to demonstrate the peculiarities of the basic algorithmic structures and their compositions;

ability to choose and apply the most appropriate forms, methods, technologies and teaching aids for conducting lessons on algorithmization using robotic devices.

2.3.3. Criteria and forms of evaluation of learning outcomes on the topic.

Forms of evaluation: formative evaluation of messages, compilation of a technological map of the lesson on algorithmization, demonstration of the work of a robotic device as an executor of algorithms.

Evaluation criteria	*Quantitative and / or qualitative characteristics*
knowledge of the concept of the performer of the algorithm, the advantages and didactic expediency of the use of robotic devices as performers in the process of forming algorithmic thinking in the school course of computer science;	*High level*: the student has a systematic, reasoned, deep knowledge of educational material, is able to independently assess some new facts and phenomena, uses a variety of sources of information *Sufficient level*: the student possesses the educational material at a sufficient level, reasonably states its main content during the answers, but without a comprehensive analysis and argumentation. *Average*: the student partially owns the study material, but shows basic knowledge. During the answers he teaches the educational material in fragments, superficially, insufficiently reveals the content of theoretical questions and practical tasks. *Initial level*: the student partially or insufficiently owns the educational material, operates with initial ideas during the answers, insufficiently reveals the content of theoretical questions, admits inaccuracies and errors.
ability to choose and use robotic devices to demonstrate the peculiarities of the basic algorithmic structures and their compositions;	*High level*(20 points) The developed technological map of the lesson with demonstration on the basis of control of the robotic device corresponds to the methodical system of teaching computer science on the formation of algorithmic thinking. The student independently formulates the expected results on the relevant topic, is able to organize a discussion of the demonstration, to draw conclusions about the special situations of application of each of the algorithmic constructions. The student is fluent in terminology. A variety of technological tools are adequately used. The presented information is scientific, meets the program requirements. No errors.

	Sufficient level (16 points) The developed technological map of the lesson with demonstration on the basis of control of the robotic device corresponds to the methodical system of teaching computer science on the formation of algorithmic thinking. The student independently formulates the expected results on the relevant topic, is able to organize a discussion of the demonstration, to draw conclusions about the special situations of application of each of the algorithmic constructions. The expediency of choosing a robotic device is partially justified. The presented information is scientific, meets the program requirements. There are minor flaws in the information provided. *Average* (10 points) The developed technological map of the lesson with demonstration on the basis of control of the robotic device is executed mainly with observance of modern methodical requirements. The expediency of choosing a robotic device is insufficiently substantiated. The information provided is scientific, but sometimes the software requirements are not met. There are no more than two errors in the presented information. *Low level* (4 points) In the developed technological card of the lesson there are significant flaws in the observance of modern technologies. The expediency of choosing a robotic device is insufficiently substantiated. The information provided is scientific, but the program requirements are not met. There are more than two errors in the presented information.

2.3.4. Digital tools. Tools for working in a network environment, with electronic documents; with mobile learning devices; with visualization tools.

2.3.5. Innovative learning technologies. Technologies for the development of critical thinking, problem-oriented learning, blended learning, distance learning technologies.

2.3.6. Lecture 3.1. Methodical featuresapplication of robotic systems in teaching algorithmization (1:00)

Plan:

1. Brief description of the existing methodological system of teaching computer science on the formation of algorithmic thinking.

2. The role of the concept of "performer" in the formation of algorithmic thinking. Types and examples of performers. Environment, system of commands of the formal executor. Advantages of teaching methods based on the concept of performer.

3. A typical structure of a lesson on learning algorithms using a demonstration of a robotic device as a formal performer. Typical tasks.

2.3.7 Laboratory lesson 1.1. Information and software tools for learning the basics of algorithmization using robotics. Application of a robotic device for training in solving typical algorithmic problems

2.3.8. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using different types of performers for algorithm training (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.3.9. Tasks for independent work of students.

1. Prepare a presentation justifying the choice of robotic device to demonstrate the implementation of basic types of algorithms and their combinations.
2. Development of technological maps of algorithmic lessons based on the use of a robotic device that is the executor of algorithmic constructions.

2.3.10. Methodical materials and instructions.

Lecture notes №3.1available at the link https://moped.pdpu.edu.ua/

2.3.11. TOPIC 2. Features of the use of robotic devices in teaching modeling

2.3.12. Purpose and expected results.

Goal: to form in students-future teachers of computer science ideas about the existing methodical system of teaching modeling, the role of robotic complexes as a means of learning.

Expected results:

knowledge of the concept of model, advantages and didactic expediency of the use of robotic devices as a model of performers in the school course of computer science;

ability to select and use robotic devices to demonstrate the creation and use of a control model of the performer;

ability to choose and apply the most appropriate forms, methods, technologies and teaching aids for modeling lessons using robotic devices.

2.3.13. Criteria and forms of evaluation of learning outcomes on the topic.

Forms of evaluation: formative evaluation of messages, drawing up a technological map of the modeling lesson, demonstration of the work of a robotic device as a performer on the basis of the developed model.

Evaluation criteria	*Quantitative and / or qualitative characteristics*
knowledge of the concept of model, modeling of objects and processes,	*High level*: the student has a systematic, reasoned, deep knowledge of educational material, is able to independently assess some

advantages and didactic expediency of application of robotic devices as objects of modeling in a school course of computer science;	new facts and phenomena, uses a variety of sources of information *Sufficient level*: the student possesses the educational material at a sufficient level, reasonably states its main content during the answers, but without a comprehensive analysis and argumentation. *Average*: the student partially owns the study material, but shows basic knowledge. During the answers he teaches the educational material in fragments, superficially, insufficiently reveals the content of theoretical questions and practical tasks. *Initial level*: the student partially or insufficiently owns the educational material, operates with initial ideas during the answers, insufficiently reveals the content of theoretical questions, admits inaccuracies and errors.
ability to select and use robotic devices to demonstrate the creation and use of a control model of the performer;	*High level*(20 points) The developed technological map of the lesson with demonstration on the basis of control of the robotic device corresponds to the methodical system of teaching computer science on the formation of modeling skills. The student independently formulates the expected results on the relevant topic, is able to organize a discussion of the demonstration, come to conclusions and generalizations about the role of models in practice. The student is fluent in terminology. A variety of technological tools are adequately used. The presented information is scientific, meets the program requirements. No errors. *Sufficient level* (16 points) The developed technological map of the lesson with demonstration on the basis of control of the robotic device corresponds to the methodical system of teaching computer science on

	modeling. The student independently formulates the expected results on the relevant topic, is able to organize a discussion of the demonstration, come to conclusions and generalizations about the role of models in practice. The expediency of choosing a model in solving a practical problem is partially justified. The presented information is scientific, meets the program requirements. There are minor flaws in the information provided. *Average* (10 points) The developed technological map of the lesson with demonstration on the basis of control of the robotic device is executed mainly with observance of modern methodical requirements. The expediency of choosing a model for controlling a robotic device is insufficiently substantiated. The information provided is scientific, but sometimes the software requirements are not met. There are no more than two errors in the presented information. *Low level* (4 points) In the developed technological card of the lesson there are significant flaws in the observance of modern technologies. The expediency of choosing a model for controlling a robotic device is insufficiently substantiated. The information provided is scientific, but the program requirements are not met. There are more than two errors in the presented information.

2.3.14. Digital tools. Tools for working in a network environment, with electronic documents; with mobile learning devices; with visualization tools.

2.3.15. Innovative learning technologies. Technologies for the development of critical thinking, problem-oriented learning, blended learning, distance learning technologies.

2.3.16. Lecture 3.2. Methodical featuresapplication of robotic systems in teaching modeling (1:00)

Plan:

1. Brief description of the existing methodological system of teaching computer science on the formation of systems thinking and modeling skills.

2. The role of the concept of "performer" as a means of modeling, a typical model of a formal performer, features of modeling management of the performer. Advantages of teaching methods based on the performer model.

3. A typical structure of a lesson on modeling training using a demonstration of a robotic device based on a control model of the performer. Typical tasks.

2.3.17. Laboratory lesson 2.1. Modeling based on the use of robotic devices. Solving practical problems using robotic devices (2 hours).

2.3.18. Topics of individual and / or group tasks.

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using models of control of robotic devices for modeling training (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.3.19.Tasks for independent work of students.

1. Prepare a presentation justifying the choice of control model of a robotic device to solve an applied problem.
2. Development of technological maps of lessons on modeling of management by the executor in the form of the robotic device.

2.3.20. Methodical materials and instructions.

Lecture notes №3.2available at the link https://moped.pdpu.edu.ua/

2.4. Content module 4. Methods of teaching the basics of robotics

2.4.1. Topic 1. A brief history of the formation of educational robotics. General characteristics and features of teaching the basics of robotics for children.

2.4.2. Purpose and expected results.

Goal: to acquaint students with a brief history of educational robotics, features of teaching robotics according to age.

Expected results:

Apply innovative technologies for the organization of educational and cognitive activities;

Demonstrate readiness to form and develop algorithmic and digital competence of students.

2.4.3. Criteria and forms of evaluation of learning outcomes on the topic

Forms of evaluation: formative and summative assessment.

Evaluation criteria	Quantitative and / or qualitative characteristics
Knowledge and understanding of the content, purpose, benefits and history of robotics in education1.	High level - the student knows and understands the content, purpose, history and advantages of educational robotics Intermediate level - the student knows and partially understands the content,

	purpose, history and benefits of educational robotics Low level - the student knows and partially understands the content, purpose, history and advantages of educational robotics
Ability to develop independently fragments of the lesson using robotic accessories.	High level - the student independently: formulates the expected results in accordance with Bloom's taxonomy on the relevant topic with the use of robotic devices, develops a scheme of classes using this technology, and allocates formative and summative assessment. Intermediate level - student in part: formulates the expected results in accordance with Bloom's taxonomy on the relevant topic using robotic devices, develops a lesson plan using this technology, and identifies formative and summative assessment. Low level - the student with the help of the teacher: formulates the expected results in accordance with Bloom's taxonomy on the relevant topic using robotic devices, develops a scheme of classes using this technology,

2.4.4. Digital tools. Tools for working in a network environment, with electronic documents; with mobile learning devices; with visualization tools.

2.4.5. Innovative learning technologies.

Technologies for the development of critical thinking, technology of problem-based learning, technology of research learning.

Innovative classrooms: study, work area and brainstorming area.

2.4.6. Lecture History of formation and development of educational robotics

Plan:

1. History of educational robotics.
2. The place and role of educational robotics in education.

2.4.7. Laboratory lesson 1.1.

Methods of conducting introductory classes. Safety instructions. Dangers in the laboratory of robotics. Use multimedia, game techniques to learn how to work safely.

2.4.8. Topics of individual and / or group tasks

(Face-to-Face Phase)

1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using different classes of robotic systems to solve applied problems (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.4. 9. Tasks for independent work of students:

Study the structure of the lesson plan. Choose hardware and software depending on the purpose and individual characteristics of students. Develop a lesson plan for a lesson on new knowledge in robotics.

Evaluation criteria	*Excellent (5 points)*	*Good (4 points)*	*Satisfactory (3 points)*	*Poor. (2 points)*
Ability to develop lessons from new knowledge.	*The task is done correctly: the student develops lessons new knowledge.*	*task performed, but some minor inaccuracies were made: student develops lessons new knowledge allowing with some minor inaccuracies.*	*the task is performed partially or with gross errors: student with the help of the teacher develops lessons on new knowledge.*	*task completed wrong at or the task is not completed*

2.4.10. Methodical materials and instructions:

The synopsis of the lecture №1 is available at the link ……. [URL].

The presentation of lecture №1 is available at the link ……. [URL].

2.4.11. Topic 2. Features filling and concretization of structural components of the methodical system of robotics training.

2.4.12. Purpose and expected results

Goal: to acquaint students with the components of the methodological system teaching robotics concise history educational robotics, features of robotics training according to age.

Expected results:

Apply innovative technologies for the organization of educational and cognitive activities;

Demonstrate readiness to form and develop algorithmic and digital competence of students.

2.4.13. Criteria and forms of evaluation of learning outcomes on the topic.

Forms of evaluation: formative and summative assessment.

Evaluation criteria	Quantitative and / or qualitative characteristics
Knowledge and understanding of the content of the components of the methodical system of robotics education.	High level - the student knows and understands the content of the components of the methodical system of robotics education Intermediate level - the student knows and partially understands the content of the components of the methodical system of education robotics Low level - the student knows and partially understands the content of the components of the methodical system of education robotics
Ability to develop independently fragments of the lesson dealing with using robotic accessories.	High level - the student independently: formulates the expected results in accordance with Bloom's taxonomy on the relevant topic with the use of robotic devices, develops a scheme of classes using this technology, and allocates formative and summative assessment.

	Intermediate level - student in part: formulates the expected results in accordance with Bloom's taxonomy on the relevant topic using robotic devices, develops a lesson plan using this technology, and identifies formative and summative assessment. Low level - a student with the help of a teacher: formulates the expected results according to Bloom's taxonomy on the relevant topic using robotic devices, develops a lesson plan using this technology, and allocates formative and summative assessment.

2.4.14. Digital tools.

Tools for working in a network environment, with electronic documents; with mobile learning devices; with visualization tools.

2.4.15. Innovative learning technologies

Technologies for the development of critical thinking, technology of problem-based learning, technology of research learning.

Innovative classrooms: study, work area and brainstorming area.

2.4.16 Lecture. Methodical system of robotics training (1:00)

Plan:

1. Structural components of the methodical system of education.
2. Features of the relationship between the components of the methodological system of robotics education.

2.4.17 Laboratory lesson 2.1. Methodical features of teaching propaedeutic robotics. Drawing up a lesson plan for propaedeutic robotics using game techniques.

2.4.18 Topics of individual and / or group tasks

(Face-to-Face Phase)

1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using different classes of robotic systems to solve applied problems (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.4.19 Tasks for independent work of students:

Study of methodical features of robotics training: development, compilation, testing of robots. Creating a lesson plan for robot design. Business games.

Evaluation criteria	*Excellent (5 points)*	*Good (4 points)*	*Satisfactory (3 points)*	*Unsatisfactory Fr. (2 points)*
Ability to develop lessons from new knowledge.	*the task is done correctly: the student develops lessons new knowledge.*	*task performed, but some minor inaccuracies were made: student develops lessons new knowledge allowing with some minor inaccuracies.*	*the task is performed partially or with gross errors: student with the help of the teacher develops lessons on new knowledge.*	*task completed wrong at or the task is not completed*

2.4.20. Methodical materials and instructions:

The synopsis of the lecture is available at the link https://moped.pdpu.edu.ua/

The lecture presentation is available at https://moped.pdpu.edu.ua/

2.4.21. Topic 3. Group active methods. Teamwork on projects.

2.4.22. Purpose and expected results.

Goal: to acquaint students with group active teaching methods and their specifics during robotics classes.

Expected results:

Apply innovative technologies for the organization of educational and cognitive activities;

Demonstrate readiness to form and develop algorithmic and digital competence of students.

2.4.23. Criteria and forms of evaluation of learning outcomes on the topic.

Forms of evaluation: formative and summative assessment.

Evaluation criteria	Quantitative and / or qualitative characteristics
Knowledge and understanding of the use of active and group forms of robotics classes.	High level - the student knows and understands the content of the use of active and group forms of robotics classes. Intermediate level - the student knows and partially understands the content of use active and group forms of robotics classes. Low level - the student knows and partially understands the content of the use of active and group forms of robotics classes.
Ability to develop independently fragments of the lesson using group active learning methods.	High level - the student independently: formulates the expected results in accordance with Bloom's taxonomy on the relevant topic with the use of robotic

	devices, develops a scheme of classes using this technology, and allocates formative and summative assessment. Intermediate level - student in part: formulates the expected results in accordance with Bloom's taxonomy on the relevant topic using robotic devices, develops a lesson plan using this technology, and identifies formative and summative assessment. Low level - a student with the help of a teacher: formulates the expected results according to Bloom's taxonomy on the relevant topic using robotic devices, develops a lesson plan using this technology, and allocates formative and summative assessment.

2.4.24. Digital tools. Tools for working in a network environment, with electronic documents; with mobile learning devices; with visualization tools.

2.4.25. Innovative learning technologies. Technologies for the development of critical thinking, problem-oriented learning, blended learning, distance learning technologies.
Innovative classrooms: study, work area and brainstorming area.

2.4.26. Lecture. Active methods of teaching Robotics

Plan:

1. Description of group and active teaching methods.
2. Features of the use of group and active teaching methods during robotics training.

2.4.27. Laboratory lesson 3.1. Application of active methods in teaching robotics. Organizational forms of collective and individual work while working in the laboratory.

2.4.28. Topics of individual and / or group tasks

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using different classes of robotic systems to solve applied problems (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.4.29. Tasks for independent work of students:

Study of features of the organization of joint work. Drawing up a technological map of a joint project.

Evaluation criteria	*Excellent (5 points)*	*Good (4 points)*	*Satisfactory (3 points)*	*Poor. (2 points)*
Skill elaborate lessons with robotics kit from the use of m active and group teaching methods.	*the task is done correctly: the student develops lessons from robotics kit using active and group methods teaching*	*task performed, but some minor inaccuracies were made: student develops lessons from robotics kit from using m active and group teaching methods, some minor inaccuracies are allowed.*	*the task is performed partially or with gross errors: student with the help of a teacher develops lessons with from robotics kit from use of active and group teaching methods*	*task completed wrong at or the task is not completed*

2.4.30. Methodical materials and instructions:

The synopsis of the lecture is available at the link https://moped.pdpu.edu.ua/

The lecture presentation is available at the link https://moped.pdpu.edu.ua/

2.4.31. Topic 4. Interdisciplinary nature of learning. Formation of integration relationships depending on the individual characteristics of students. Features of STEM, STEAM and STREAM learning technologies.

2.4.32. Purpose and expected results

Goal: to acquaint students with the peculiarities of the use and application of interdisciplinary connections in the teaching of robotics.

Expected results:

Apply innovative technologies for the organization of educational and cognitive activities;

Demonstrate readiness to form and develop algorithmic and digital competence of students.

2.4.33 Criteria and forms of evaluation of learning outcomes on the topic.

Forms of evaluation: formative evaluation of messages, drawing up a technological map of the modeling lesson, demonstration of the work of a robotic device as a performer on the basis of the developed model.

Evaluation criteria	Quantitative and / or qualitative characteristics
Knowledge and understanding using interdisciplinary connections during robotics classes.	High level - the student knows and understands the content of the use of interdisciplinary connections during robotics classes. Intermediate level - the student knows and partially understands the content of the use of interdisciplinary links during robotics classes

	Low level - the student knows and partially understands the content of the use of interdisciplinary connections during robotics classes.
Ability to independently develop fragments of the lesson using interdisciplinary connections.	High level - the student independently: formulates the expected results in accordance with Bloom's taxonomy on the relevant topic with the use of robotic devices, develops a scheme of classes using this technology, and allocates formative and summative assessment. Intermediate - student in part: formulates expected results according to Bloom's taxonomy on the relevant topic using Robotic devices, develops a lesson plan using this technology, allocates formative and summative assessment. Low level - a student with the help of a teacher: formulates the expected results according to Bloom's taxonomy on the relevant topic using robotic devices, develops a lesson plan using this technology, and allocates formative and summative assessment.

2.4.34. Digital tools. Tools for working in a network environment, with electronic documents; with mobile learning devices; with visualization tools.

2.4.35. Innovative learning technologies. Technologies for the development of critical thinking, problem-oriented learning, blended learning, distance learning technologies.

Innovative classrooms: study, work area and brainstorming area.

2.4.36. Lecture. Didactic and methodical features of interdisciplinary connections in teaching Robotics.

Plan:

1. Description from the didactic and methodological point of view of the importance of using interdisciplinary links in the learning process.
2. Features of the use of interdisciplinary links in the teaching of robotics.

2.4.37. Laboratory lesson 4.1. Methodical features of conducting integrated classes in robotics. Examples of solving transdisciplinary applied problems. Creating an integrated lesson plan.

2.4.38. Topics of individual and / or group tasks

(Face-to-Face Phase) 1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using different classes of robotic systems to solve applied problems (Interactive learning area; brainstorming area).

(Post Phase) 3. Group work: round table discussion on the results of group work (Interactive learning area).

2.4.39. Tasks for independent work of students:

To study the tasks aimed at the development of personality during the training of robotics. Integration of technical and humanitarian components in solving problems.

Criteria	*Perfectly*	*Fine*	*Satisfactorily*	*Unsatisfactory*
evaluation	*(5 points)*	*(4 points)*	*(3 points)*	*at (2 points)*
Skill elaborate lessons with robotics kit using interdis	*the task is performed correctly: student develops lessons with robotics kit using interdisciplinary connections*	*task performed, but some minor inaccuracies were made: student develops lessons with robotics kit using interdisciplinary connections some minor inaccuracies allowed*	*the task is performed partially or with gross errors: student with the help of a teacher develops lessons with from robotics kit using interdis*	*task performed incorrectly at or the task is not completed*

2.4.40. Methodical materials and instructions:

The synopsis of the lecture is available at the link https://moped.pdpu.edu.ua/

The lecture presentation is available at the link https://moped.pdpu.edu.ua/

2.4.41. Topic 5. Features of the use of technical means of training in the teaching of robotics. Organizational and methodological aspects of forming hardware configurations for didactic purposes and tasks.

2.4.42. Purpose and expected results

Goal: to acquaint students with the peculiarities of the use of technical teaching aids in accordance with didactic goals and objectives.

Expected results:

Apply innovative technologies for the organization of educational and cognitive activities;

Demonstrate readiness to form and develop algorithmic and digital competence of students.

2.4.43. Criteria and forms of evaluation of learning outcomes on the topic.

Forms of evaluation: formative evaluation of messages, drawing up a technological map of the modeling lesson, demonstration of the work of a robotic device as a performer on the basis of the developed model.

Evaluation criteria	Quantitative and / or qualitative characteristics
Knowledge and understanding of the use of technical teaching aids in accordance with the didactic goals and objectives during robotics classes.	High level - the student knows and understands the content of the use of technical teaching aids in accordance with the didactic goals and objectives during classes in robotics. Intermediate level - the student knows and partially understands the content of the use of technical teaching aids in accordance with the didactic goals and objectives during classes in robotics Low level - the student knows and partially understands the content of the use of technical teaching aids in accordance with the didactic goals and objectives during classes in robotics.

Ability to develop independently fragments of the lesson using technical teaching aids in accordance with the didactic goals and objectives.	High level - the student independently: formulates the expected results in accordance with Bloom's taxonomy on the relevant topic with the use of robotic devices, develops a scheme of classes using this technology, and allocates formative and summative assessment. Intermediate level - student in part: formulates the expected results in accordance with Bloom's taxonomy on the relevant topic using robotic devices, develops a lesson plan using this technology, and identifies formative and summative assessment. Low level - a student with the help of a teacher: formulates the expected results according to Bloom's taxonomy on the relevant topic using robotic devices, develops a lesson plan.

2.4.44. Digital tools. Tools for working in a network environment, with electronic documents; with mobile learning devices; with visualization tools.

2.4.45. Innovative learning technologies. Technologies for the development of critical thinking, problem-oriented learning, blended learning, distance learning technologies.

Innovative classrooms: study, work area and brainstorming area.

2.4.46. Lecture. Didactic goals of robotics training.

Plan:

1. Didactic goals and objectives of robotics training.
2. Features of the use of technical teaching aids in accordance with the peculiarities of didactic goals and objectives of robotics training.

2.4.47. Laboratory lesson 5.1.: The choice of the configuration of the robotic complex depending on the didactic purpose. Creating tables of necessary software and hardware for courses.

2.4.48. Topics of individual and / or group tasks.

(Face-to-Face Phase)

1. Individual work: survey of students on the basic concepts of the topic (Area of interactive learning).

2. Group work on creating a map of opinions on the advantages and disadvantages of using different classes of robotic systems to solve applied problems (Interactive learning area; brainstorming area).

(Post Phase)

3. Group work: round table discussion on the results of group work (Interactive learning area).

2.4.49. Tasks for independent work of students:

Study and consideration of the main hardware and software limitations in solving didactic problems in robotics classes. Creating tables of didactic-equivalent configurations.

Evaluation criteria	*Excellent (5 points)*	*Good (4 points)*	*Satisfactory (3 points)*	*Unsatisfactory Fr. (2 points)*
Skill elaborate lessons from robotics kit using technical means of training.	*the task is performed correctly: student develops lessons with robotics kit using pits of technical means teaching*	*task performed, but some minor inaccuracies were made: student develops lessons with robotics kit using technical means of training some minor inaccuracies allowed*	*the task is performed partially or with gross errors: student with the help of a teacher develops lessons with from robotics kit from using m technical means of training*	*task performed incorrectly at or the task is not completed*

2.4.50. Methodical materials and instructions:

The synopsis of the lecture is available at the link https://moped.pdpu.edu.ua/

The lecture presentation is available at the link https://moped.pdpu.edu.ua/

3. Tasks for final certification.

3.1. List of questions for final certification.

1. Describe the history of the concept of "robotics" in education.
2. Describe the principles of operation of microcontroller ports
3. Name the didactic features of robotics training.
4. Describe the features of robotics training.
5. Formulate the purpose of teaching robotics.
6. Discover the essence and purpose of the introduction of robotics in the process of learning algorithmization
7. Describe the innovative approaches to the implementation of educational robotics.
8. Discover the historical aspects of the emergence of educational robotics.
9. Describe the purpose of educational design in robotics lessons.
10. Describe the main components of the implementation of design technology in the teaching of robotics.

3.2. Test tasks (if available).

3.3. Additional creative tasks (if available).

1) Carry out a comparative analysis of the technological map of the lesson of learning basic algorithmic structures with the use of robotic environment and without it.
2) To systematize the teaching of robotics in accordance with the forms of organization of the educational process in ZSSO.

3.4. The procedure for final certification.

Distribution of points received by students

Module I		Module II		TOTAL	Examination
C.M. 1	C.M.2	C.M.1	C.M.2		
T.1 - 7	T.1 - 12	T. 1-3	T. 1-5		
14	12	24	40	90	10

C.M. - content modules

T.1, T.2 - topics of content modules

Approximate assessment of different types of students' activities (in points)

Activities	*Score*
Performing practical work	*2*
Passing online testing	*7*
Development of creative work	*16*
Individual research task	*4*
Together	*90*
Examination	*10*
TOTAL	*100*

4. List of recommended reading

1. Mazurok TL, Smetanina LS Methodical instructions for laboratory work on methods of teaching computer science. - Odessa: PNPU. K.D. Ushinsky, 2006. - 64 p.

2. Educational program with computer sciencefor 5-9 classes general education training institutions. Website MOH Of Ukraine. Regime access: https://mon.gov.ua/ua/osvita/zagalna-serednya-osvita/navchalni-programs/navchalni-programi-5-9-klas

3. Morse NV Methods of teaching computer science: Textbook. manual.: In 3 hours - K .: Textbook, 2004. - Part IV: Methods of teaching the basics of algorithmization and programming. - 368c.

4. Semenova OI Ways of forming algorithmic skills and abilities of students // Computer in school and family. - 2009. - №4. - P.24-27.

5. Box, Alexander Bogdanovich. Methods of teaching algorithmization and programming of high school students at the level of in-depth study of computer science: dissertation abstract. ... cand. ped. Sciences: 13.00.02 / OB Box; Science. ker. Yu. S. Ramsky; Ministry of Education and Science of Ukraine, Nat. ped. Univ. MP Dragomanova. - Kyiv, 2016. - 20 p.

6. Presentation "Basic requirements for studying the topic "Algorithmization". - Access mode: https://svitppt.com.ua/informatika/osnovni-vimogi-do-vivchennya-themes-based-algorithmization-.html

7. ALGO learning environment. - Access mode:http: // petriv.ho.com.ua/algo /

8. Pakhomova GV Computer Science. Introduction to Logo programming. 5th grade. Textbook / Shepetivka: "PE Shestopalov EA", 2007. - 136 p.

9. Pakhomova GV LOGO programming. 6th grade. Textbook / G.V. Pakhomova / - Shepetivka: "PE Shestopalov", 2010. - 136 p.

10. Malyarchuk SN In computer science with Logo. Textbook. - H .: ABC, 2002. – 256 s.

11. Modern information tools for learning / [P.K. Гороль, P.C. Гуревич, Л.О. Konoshevsky, O.V. Shestopalov]. - Kyiv: Education of Ukraine, 2007. - 536 p.

12. Buynytska OP Information technologies and technical means of education. Teaching. way. - Kyiv: Center for Educational Literature, 2012. - 240 p.

13. Morse NV Methods of teaching computer science: Textbook. aid .: At 3 o'clock - K .: Textbook. book, 2004. - part 1: General methods of teaching information technology. - 256 p.

14. Website pedagogical community Rivne region. - Regime access: https://plus.google.com/communities/114779115822263143914

15. On-line platform Prometheus / - Regime access: https://prometheus.org.ua/

16. Morse NV Textbook of informatics for students of 5th grade secondary schools / NV Morse, O.W. Barna, V.P. Wember, O.G. Kuzminskaya. - K .: UOVC "Orion", 2018. - 260 p.

17. Rivkind YY, Lysenko TI, Chernikova LA, Shakotko VV Computer Science. Textbook for 5th grade - K .: Genesis, 2013. - 200 p

18. Asimov, Isaac (1996) [1995]. "The Robot Chronicles." Gold. London: Voyager. pp. 224–225. ISBN 978-0-00-648202-4.

- Griffin T., Art of LEGO MINDSTORMS EV3 Programming [text] / T. Griffin. - San Francisco: No Starch Press, 2014. - 252 p. 6. Yoshihito Isogava, The LEGO "MINIDSTORMS" EV3 Idea Book [text] / T. Griffin. -San Francisco: No Starch Press, 2014. - 252 p.

19. Nocks, Lisa (2007). The robot: the life story of a technology. Westport, CT: Greenwood Publishing Group.

20. Steven Umbrello & Roman Yampolskiy. Designing AI for Explainability and Verifiability: A Value Sensitive Design Approach to Avoid Artificial Stupidity in Autonomous Vehicles.

21. Wettels, N .; Santos, VJ; Johansson, RS; Loeb, Gerald E .; et al. (2008). "Biomimetic tactile sensor array". Advanced Robotics. 22 (8): 829– 849. doi:10.1163 / 156855308X314533.

22. The LEGO "MINIDSTORMS" EV3 Idea Book [text] / T. Griffin. - San Francisco: No Starch Press, 2014. - 252 p

22. Pokryshen D. A selection of master classes and cognitive YouTube channels with ideas for school STEM-projects [Electronic resource] / D. Pokryshen // Development of a creative child. - Access mode: https://tvorchistd.blogspot.com/2018/05/youtube-stem.html?m=1. 6. Draft Concept of STEM-education in Ukraine [Electronic resource]. - Access mode:http://mk-kor.at.ua/STEM/STEM_2017.pdf (review date March 26, 2018)

FOR NOTES

FOR NOTES

Навчальне видання

Освітня робототехніка

Методичний посібник
для студентів спеціальності «014 Середня освіта (інформатика)»
Ступінь вищої освіти: «Бакалавр»

Методичний посібник

Англійською мовою

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