Syllabus
lighting component SC

Programming and scientific research in Python

Subjects:	**Programming intelligent systems in Python**
Level of higher education:	**first (undergraduate)**
Course page in Moodle:	*https://mf.khadi.kharkov.ua/departments/kompjuternikh-tekhnologii-i-mekhatroniki/navchalna-robota/informaciinii-paket-specialnosti-121-2016-2019-rr/*
The scope of the educational component	**4 credits (120 hours)**
Final control form	**Test**
Consultations:	**on schedule**
Name of the department:	**Department of Computer Technologies and Mechatronics**
Teaching language:	**English**
Course leader:	**Serhii Viktorovych Pronin, Ph.D., associate professor**
Contact phone number:	**050-181-22-74**
Email:	**sergiy9977@ukr.net**

Brief content of the educational component:

The **goal** is the formation in students of general cultural and professional competences, knowledge, abilities and skills of mastering the modern apparatus of the theory of artificial intelligence and methods of synthesis, analysis and effective use of intellectual information systems for solving applied tasks of the final structure of the bachelor's subject area.

Subject: theoretical, methodological and programming foundations of artificial intelligence systems and the Python programming language.

The main **tasks** of studying an academic discipline are:

- to analyze, purposefully search for and choose information and reference resources and knowledge necessary for solving professional tasks, taking into account modern achievements of science and technology;
- the ability to choose and use the software development methodology appropriate to the task;
- know effective approaches to software design;
- know and apply methods of algorithm development, construction;
- motivated to choose programming languages and development technologies to solve the tasks of creating and maintaining software;
- to know and be able to develop and implement modern innovative information technologies of design in the field of intelligent transport systems and mechatronic systems and complexes.

Thematic plan

№ of topic	Name of topics (LK, LR, PR, SZ, SR)	Number of hours	
		intramural	extramural
1	2	3	4
1	LC Introduction to the Python programming language	2	2
	PR Syntax of the Python language	4	4
	SR An overview of the Python standard library	6	6
2	LK Python data structures	2	2
	PR Work with data structures	4	4
	SR Built-in data types	6	6
3	LK Working with files in Python	2	2
	PR Working with files in Python	4	4
	SR I/O functions	6	6
4	LK Libraries for the creation of artificial intelligence systems and scientific research	2	2
	PR Overview of libraries for artificial intelligence systems	4	4
	SR Overview of libraries for artificial intelligence systems	14	14
5	LK. Machine learning	4	4
	PR Data analysis using machine learning algorithms	8	8
	SR Overview of libraries for pattern recognition	20	20
6	LK. Deep neural networks	4	4
	PR Building a deep neural network using the Keras library.	8	8
	SR An overview of the Tenzor Flow library	20	20
	ALL by discipline	120	120

Individual educational and research task (if available):

Teaching methods:
1) verbal: 1.1 traditional: lectures, explanations, stories, etc.;
1.2 interactive (non-traditional): problem lectures, discussions, etc.;
2) visual: method of illustrations, method of demonstrations
3) practical: 3.1 traditional: practical classes, seminars;
3.2 interactive (non-traditional): business and role-playing games, trainings, seminars-discussions, "round table", brainstorming method.

Evaluation system and requirements:

Current performance
1 The current success of applicants for the performance of educational types of work in training sessions and for the performance of independent work tasks is evaluated using a four-point rating scale with subsequent transfer to a 100-point scale. During the evaluation of the current academic performance, all types of work provided by the educational program are taken into account.
1.1 Lecture classes are evaluated by determining the quality of performance of specified

tasks.

1.2 Practical classes are evaluated by the quality of performance of a control or individual task, performance and design of practical work.

1.3 Laboratory classes are evaluated by the quality of reports on the performance of laboratory work.

1.4 Seminar classes are evaluated by the quality of individual assignment/abstract.

Final assessment

1 A student of higher education receives a credit in the last lesson in the discipline based on the results of the current assessment. The average score for the current activity is converted into points on a 100-point scale, according to the conversion table (table 1). Applicants for higher education who have a current grade point average in the discipline lower than "3" (60 points) can increase their current grade by taking tests in the discipline in the last session.

Assessment of the knowledge of applicants through testing is carried out according to the following scale:

– "Excellent": at least 90% of correct answers;

– "Very good": from 82% to 89% of correct answers;

– "Good": from 74% to 81% of correct answers;

– "Satisfactory": from 67% to 73% of correct answers;

– "Satisfactory enough": from 60% to 66% of correct answers;

– "Unsatisfactory": less than 60% of correct answers.

2 The condition for obtaining credit is:

- making up for all missed classes;

– the average current grade in the discipline is not lower than "3" (60 points).

3 For performing individual independent work and participation in scientific events, additional points are awarded to the winners.

3.1 Additional points are added to the sum of points scored by the student of higher education for the current educational activity (for disciplines for which the final form of control is a credit), or to the final grade in the discipline for which the final form of control is an exam.

3.2 The number of additional points awarded for different types of individual tasks depends on their volume and importance:

- prizes in the discipline at the international / all-Ukrainian competition of scientific student works - 20 points;

- prize places in the discipline at the All-Ukrainian Olympiads - 20 points;

- participation in the international / all-Ukrainian competition of scientific student works - 15 points

- participation in international / all-Ukrainian scientific conferences of students and young scientists - 12 points;

- participation in all-Ukrainian Olympiads in the discipline - 10 points

- participation in Olympiads and scientific conferences of the Khnadu in the discipline - 5 points;

- performance of individual scientific and research (educational and research) tasks of increased complexity - 5 points.

3.3 The number of additional points cannot exceed 20 points.

4 The learning result is evaluated (select is required):

– on a two-point scale (passed/failed) according to table 2;

– on a 100-point scale (for differentiated assessment) according to table 3.

The final grade together with additional points cannot exceed 100 points.

Table 1 – Scale for transferring points to the national evaluation system

On a 100-point scale	On a national scale
from 60 points to 100 points	are counted
less than 60 points	are not counted

Table 2 – The scale for evaluating the knowledge of students based on the results of the final control of the academic discipline

Evaluation in points	Evaluation according to the national scale		Evaluation according to the ECTS scale	
	examination	test	Rating	Criteria
90-100	Perfectly	Enrolled	A	The theoretical content of the course has been mastered in its entirety, without gaps, the necessary practical skills for working with the mastered material have been formed, all educational tasks provided for in the training program have been completed, the quality of their performance has been assessed with a number of points close to the maximum
80–89	Okay	Enrolled	B	The theoretical content of the course has been mastered in its entirety, without gaps, the necessary practical skills for working with the mastered material have mainly been formed, all educational tasks provided for by the training program have been completed, the quality of most of them has been assessed with a number of points close to the maximum
75-79			C	The theoretical content of the course has been mastered in its entirety, without gaps, some practical skills of working with the mastered material have not been formed enough, all educational tasks provided for by the training program have been completed, the quality of none of them has been assessed with a minimum number of points, some types of tasks have been completed with errors
67-74	Satisfactorily		D	The theoretical content of the course is partially mastered, but the gaps are not of a significant nature, the necessary practical skills for working with the mastered material are basically formed, most of the educational tasks provided by the training program have been completed, some of the completed tasks may contain errors

Evaluation in points	Evaluation according to the national scale		Evaluation according to the ECTS scale	
	examination	test	Rating	Criteria
60–66			E	The theoretical content of the course has been partially mastered, some practical work skills have not been formed, many educational tasks provided by the training program have not been completed, or the quality of some of them has been assessed with a number of points close to the minimum.
35–59	Unsatisfactorily	Not counted	FX	The theoretical content of the course has been partially mastered, the necessary practical work skills have not been formed, most of the prescribed training programs of educational tasks have not been completed, or the quality of their implementation has been assessed with a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of the performance of educational tasks (with the possibility of retaking)
0–34	Unacceptable		F	The theoretical content of the course has not been mastered, the necessary practical work skills have not been formed, all completed educational tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of the performance of educational tasks (with a mandatory repeat course).

Course policy:
– the course involves working in a team, the environment in the classroom is friendly, creative, open to constructive criticism;
- mastering the discipline involves mandatory attendance of lectures and practical classes, as well as independent work;
- independent work involves the study of individual topics of the academic discipline, which are presented in accordance with the program for independent study, or were considered briefly;
– all tasks provided by the program must be completed within the set time;
- if the student of higher education is absent from classes for a good reason, he presents the completed tasks during independent preparation and consultation of the teacher;
- while studying the course, students of higher education must adhere to the rules of academic integrity set forth in the following documents: "Rules of academic integrity of participants in the educational process of the Khnadu" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.p

df), "Academic integrity. Checking the text of academic, scientific and qualification papers for plagiarism" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_85_1_01.pdf), "Moral and ethical code of participants in the educational process of the Khnadu (https://www .khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).
- in case of detection of plagiarism, the applicant receives 0 points for the task and must repeat the tasks provided for in the syllabus;
- writing off during tests and exams is prohibited (including using mobile devices). Mobile devices are allowed to be used only during online testing.

Recommended literature: (literature no later than 10 years old, except for 1 fundamental classical textbook or monograph)

1. Basic literature
1. Plas J. Vander Python for Complex Tasks: Data Science and Machine Learning. — O'Reilly Bestsellers, 2021. — 576 c.
2. Building Machine Learning Systems with Python - Second Edition 2nd Edition, Kindle Edition / Luis Pedro Coelho (Author), Willi Richert (Author). – Packt Publishing; 2nd edition (March 26, 2015). – 328 pages
3. Artificial Intelligence with Python: A Comprehensive Guide to Building Intelligent Apps for Python Beginners and Developers/ Prateek Joshi (Author). Packt Publishing; 1st edition (January 27, 2017). - 448 pages.
4. Deep Learning with Python, Second Edition 2nd Edition / Francois Chollet (Author). — Manning; 2nd edition (December 21, 2021) — 504 pages.

2. Supporting literature

5.   Python documentation URL: https://docs.python.org/3.7/library/functions.html (Date of application: 16.12.2020г.).
6.   NumPy URL: https://numpy.org/ (Date of application: 15.01.2023г.).
7.   Pandas URL: https://pandas.pydata.org/ (Date of application: 15.01.2023г.).
8.   Scikit-learn URL: https://scikit-learn.org/stable/index.html (Date of application: 15.01.2023г.).
9.   TensorFlow URL: https://www.tensorflow.org/ (Date of application: 15.01.2023г.).
10.   Keras URL: https://keras.io/ (Date of application: 15.01.2023г.).

Developer(s)
the syllabus of the
academic discipline   _____   <u>Sergey PRONIN</u>
                                 signature   Full name

Head of Department   _____   <u>Oleg NIKONOV</u>
                                 signature   Full name