Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

ЗБАГАЧУЄМО КОЖНОГО
КАФЕДРА СОЦІОЛОГІЇ

Department of Sociology

Fundamentals of Artificial Intelligence

Curriculum (Syllabus)

Course details

Level of higher education	*Second (Master's)*
Field of knowledge	*C - social sciences, journalism, information and international relations*
Specialisation	*C5 Sociology*
Educational programme	*Social Data Analytics*
Status of discipline	*Elective*
Form of study	*Full-time (day)*
Year of study, semester	*1st year, 2nd semester*
Scope of the discipline	*4 ECTS credits/120 hours* *16 hours of lectures, 30 hours of practical classes, 74 hours of independent work.*
Semester assessment/assessment measures	*Test, Modular control work*
Class schedule	*https://schedule.kpi.ua/*
Language of instruction	*Ukrainian*
Information about course coordinator / lecturers	*Lecturer and practical training: Doctor of Sociology, Myroslava Pavlivna Kukhta* *miroslavakukhta@gmail.com*
Course location	*https://classroom.google.com/c/ODM2MjUxMDQxNjM0*

Curriculum

1. Description of the course, its purpose, subject matter and learning outcomes

The academic discipline "Fundamentals of Artificial Intelligence" is aimed at helping master's level students master the fundamental concepts, principles and methods of building modern intelligent systems, as well as developing the ability to critically interpret the opportunities, limitations and risks associated with the spread of artificial intelligence technologies in the public sphere, economy, management and everyday life. The course combines technical, mathematical and socio-humanitarian perspectives, providing an understanding of how algorithms, machine learning models, decision-making systems, neural networks and data processing tools function in the digital environment and how they change the structure of social processes, management decisions and interactions between people and technologies.

The course covers the history of artificial intelligence, key paradigms of logical and statistical modelling, principles of machine learning, basic neural network architectures, and methods for collecting, preparing and processing data needed to train intelligent systems. Considerable attention is paid to classification and regression algorithms, optimisation procedures, methods for evaluating model quality, and technologies for deploying intelligent solutions in the environment of public authorities and digital services. Particular emphasis is placed on the analysis of social, legal and ethical aspects of AI implementation, including issues of algorithm

transparency, data bias, responsibility for automated decisions, risks of discrimination and challenges associated with the digital transformation of management processes.

The subject of the course is the theoretical and applied foundations of artificial intelligence systems, the principles of algorithm construction, machine learning methods, the principles of neural networks, and information processing mechanisms in intelligent systems. The subject also covers the methodological foundations of data analysis as a key resource for AI, the principles of designing and integrating algorithmic solutions into public administration, digital platforms, and organisational systems.

Communication with the lecturer takes place during lectures and practical classes, as well as during individual consultations according to the schedule posted on the department's website.

The aim of the discipline is to give students a comprehensive understanding of artificial intelligence as an interdisciplinary phenomenon, the ability to analyse the technical foundations of intelligent systems, critically assess the opportunities and risks of applying algorithmic solutions in public administration, and use knowledge of machine learning, neural networks and data analysis to develop and interpret basic AI models.

In the course of studying the discipline, students acquire practical skills:

- analyse the structure of algorithms and determine their suitability for specific public administration tasks;
- evaluate the quality of machine learning models, interpret their behaviour and justify the choice of technical solutions;
- work with data, performing preliminary processing, identifying patterns and building basic AI models;
- understand the logic of neural networks and apply them to solve applied problems;
- consider the legal, ethical, and social implications of implementing intelligent systems when developing recommendations for public authorities and organisations.

The course strengthens general competencies, including the ability to think abstractly, analyse and synthesise, improve professional, intellectual and cultural levels, and make informed decisions and use modern communication technologies.

An important outcome of studying the discipline is the strengthening of professional competencies, in particular the ability to organise information and analytical support for management processes based on modern information resources and technologies, to develop tools for digital transformation in the field of public administration, and to apply digital and intelligent technologies for data analysis and decision support.

The programme outcomes strengthen the ability to use modern statistical methods, models and software tools to solve public administration problems; to communicate and argue effectively using digital technologies; to diagnose problems and make recommendations for the implementation of intelligent systems and digital transformations in the field of public administration and management.

2. Prerequisites and post-requisites of the discipline (place in the structural-logical scheme of training under the relevant educational programme)

Prerequisites: the discipline does not require specific knowledge or skills. To master the discipline, it is sufficient to have basic knowledge of computer science, logic, mathematical statistics, analytical thinking, as well as the ability to work with digital tools and basic data processing programmes.

Post-requisites: studying the discipline forms a basic understanding of the principles and methods of artificial intelligence, creates a foundation for further mastering professional disciplines related to data analysis and automated systems, and can be used in practical tasks and the preparation of a master's thesis.

3. Course content

1. The concept of artificial intelligence, the structure of intelligent systems, and the main classes of approaches
2. The main stages of development of artificial intelligence and the formation of modern methods
3. Logical models, algorithmic methods and ways of representing knowledge in AI systems
4. Machine learning methods, modelling principles and types of training procedures
5. Architecture of artificial neural networks and their learning mechanisms
6. Methods of data collection, preparation and technical analysis for AI systems
7. Fundamentals of natural language processing and language model construction

8. Generative models, autoencoders, GANs, and GPT transformer models and their technical applications

4. Learning materials and resources

To successfully study the discipline, it is sufficient to work through the training material presented in the lectures and familiarise yourself with the literature.

Main literature

1. Zhezherun, Y. V. (2020). Introduction to Artificial Intelligence. Lviv: LNU Publishing House.
2. Kovalchuk, T. M. (2022). Artificial Intelligence: Fundamentals and Applications. Kyiv: KNEU.
3. Ovcharuk, O. V. (2021). Machine Learning. Fundamentals with Examples in Python. Kharkiv: Folio.
4. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.
5. Russell, S., & Norvig, P. (2021). Artificial Intelligence: A Modern Approach (4th ed.). Pearson.

Supplementary

1. Brovko, O. A. (2021). Artificial Neural Networks and Their Applications. Kyiv: NTUU "KPI".
2. Vasilyev, V. P. (2023). Fundamentals of Natural Language Processing. Kyiv: Akademperiodyka.
3. Klimchuk, I. A. (2022). Generative models in data analysis. Kharkiv: KNURE.
4. Malik, Yu. V. (2020). Machine learning: data analysis tools. Lviv: LNU Publishing House.
5. Alpaydin, E. (2020). Introduction to Machine Learning (4th ed.). MIT Press.
6. Chollet, F. (2021). Deep Learning with Python (2nd ed.). Manning Publications.
7. Jurafsky, D., & Martin, J. H. (2023). Speech and Language Processing (3rd ed., preprint). Stanford University.
8. LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. Nature, 521(7553), 436–444. https://doi.org/10.1038/nature14539
9. OpenAI. (2023). GPT-4 Technical Report. arXiv:2303.08774. https://arxiv.org/abs/2303.08774
10. Sebastiani, F. (2002). Machine learning in automated text categorisation. ACM Computing Surveys, 34(1), 1–47. https://doi.org/10.1145/505282.505283

Educational content

5. Methods of mastering the academic discipline (educational component)

Lectures

Lecture 1

Topic 1. The concept of artificial intelligence, the structure of intelligent systems, and the main classes of approaches

Key questions: The concept of artificial intelligence as modelling rational behaviour. The structure of an intelligent agent and the components of perception, decision-making and action. Symbolic approaches as systems of rules and logical models. Statistical approaches as algorithms for evaluating parameters based on data. Deep models as multilayer neural structures. Integrated approaches as a combination of logical and statistical methods.

IW: Select three examples of AI applications and determine whether they belong to the symbolic, statistical, or deep learning approach.

Literature: Zhezherun, 2020; Kovalchuk, 2022; Russell & Norvig, 2021.

Lecture 2

Topic 2. Main stages of artificial intelligence development and formation of modern methods

Key questions: The beginning of AI development in the context of the first symbolic models. The formation of expert systems as structured production rules. Transition to statistical machine learning in response to the limitations of symbolic methods. Development of neural networks as an alternative to classical algorithms. Formation of deep models as a way to process complex features. Introduction of transformer architectures for working with sequences and language data.

IW: Create a chronological diagram of the five key stages of AI development with a brief description of their technical features.

Literature: Zhezherun, 2020; Goodfellow et al., 2016; Russell & Norvig, 2021.

Lecture 3

Topic 3. Logical models, algorithmic methods, and ways of representing knowledge in AI systems

Key questions: Formalisation of knowledge using propositional and predicate logic. Logical inference mechanisms as computational procedures. Production systems as means of constructing expert models. Semantic networks as graph structures for representing concepts. Frame structures as formalised templates of objects and situations. Limitations of logical models in tasks with incomplete and ambiguous data.

IW: Present an engineering or classification task in the form of a set of rules or a semantic network.

Literature: Zhezherun, 2020; Kovalchuk, 2022; Russell & Norvig, 2021.

Lecture 4

Topic 4. Machine learning methods, modelling principles, and types of training procedures

Key questions: The basics of supervised learning as a process of minimising the loss function. Unsupervised learning as the discovery of structures and clusters in data. Reinforcement learning as the optimisation of action policies in an environment. Linear and nonlinear models as approaches to function approximation. Regularisation methods as tools for controlling overfitting. Evaluation metrics as a means of measuring model performance.

IW: Analyse an example of a classification or regression problem and determine which type of learning procedure is appropriate for it.

References: Ovcharuk, 2021; Malik, 2020; Alpaydin, 2020.

Lecture 5

Topic 5. Architecture of artificial neural networks and their learning mechanisms

Key questions: Multilayer perceptrons as the basis of neural models. Activation functions as a mechanism for forming non-linearity. Backpropagation as a method for calculating gradients. Stochastic gradient descent as a basic optimisation algorithm. Convolutional and recurrent architectures as models for working with images and sequences. Problems of exploding and vanishing gradients as limitations of deep networks.

IW: Build a diagram of a simple neural network architecture and explain its learning mechanism.

Literature: Goodfellow et al., 2016; Brovko, 2021; Chollet, 2021.

Lecture 6

Topic 6. Methods of data collection, preparation, and technical analysis for AI systems

Key questions: Data collection as the formation of samples for training and testing models. Pre-processing as cleaning, normalising and transforming features. Feature selection as the selection of relevant parameters for the model. Sample balancing as the elimination of biases in the data. Data scaling as a condition for training stability. Technical analysis as an assessment of data structure, quality and suitability.

IW: Prepare a small dataset and perform normalisation and feature selection with a brief explanation.

References: Ovcharuk, 2021; Malik, 2020; Vasyliev, 2023.

Lecture 7

Topic 7. Fundamentals of natural language processing and language model construction

Key questions: Tokenisation as the division of text into elementary units. Vectorisation as the conversion of text into numerical representations. Models based on statistical methods as tools for evaluating the probabilities of language units. Neural language models as systems for constructing contextual representations. Architectures for working with sequences as mechanisms for taking word order into account. Evaluating language models as a measure of prediction accuracy and text consistency.

IW: Perform tokenisation and vectorisation of a small text fragment and describe the representations obtained.

Literature: Vasilyev, 2023; Jurafsky & Martin, 2023; Sebastiani, 2002.

Lecture 8

Topic 8. Generative models, autoencoders, GANs, and GPT transformer models and their technical applications

Key questions: Autoencoders as models for data compression and recovery. Variational autoencoders as generative latent representations. Generative adversarial networks as a system of two models for data

synthesis. Transformer architectures as a self-attention mechanism for sequence processing. GPT models as an example of scalable language generative systems. Technical applications of generative models in image, text, and structured data synthesis.

IW: Select a generative model and describe its architecture and typical tasks in which it is used.

Literature: Klymchuk, 2022; Goodfellow et al., 2016; OpenAI, 2023.

Seminar (practical) classes

Seminar 1

Topic 1. The concept of artificial intelligence, the structure of intelligent systems, and the main classes of approaches

Key questions: The structure of an intelligent agent and the modules of perception, evaluation, and action. AI system architectures in the context of interaction with the environment. Symbolic approaches as formalised logical methods of knowledge processing. Statistical approaches as methods for constructing parametric models based on samples. Deep approaches as systems of nonlinear multilayer generalisation.

IW: Analyse three intelligent systems and determine their architectural model.

Literature: Zhezherun, 2020; Kovalchuk, 2022; Russell & Norvig, 2021.

Seminar 2

Topic 1. The concept of artificial intelligence, the structure of intelligent systems, and the main classes of approaches

Key questions: Distinction between agents with full and incomplete access to information. The relationship between the structure of the environment and the choice of decision-making algorithm. The concept of rationality and criteria for optimal actions. Comparison of symbolic and statistical reasoning models. Hybrid systems as a means of combining logical and data-oriented methods.

Assignment: Build a functional diagram of an intelligent agent for a specific application.

Literature: Zhezherun, 2020; Kovalchuk, 2022; Russell & Norvig, 2021.

Seminar 3

Topic 2. Main stages of artificial intelligence development and the formation of modern methods

Key questions: Early symbolic algorithms and logical methods of problem solving. Expert systems as structured knowledge bases. The transition to machine learning and the growing role of data. The formation of the first neural models in recognition tasks. The emergence of deep learning and its impact on the accuracy of modern systems.

IW: Construct a historical map of technological transitions in the development of AI.

Literature: Zhezherun, 2020; Goodfellow et al., 2016; Russell & Norvig, 2021.

Seminar 4

Topic 2. Main stages in the development of artificial intelligence and the formation of modern methods

Key questions: The evolution of paradigms from symbolic reasoning to learning models. The development of statistical methods as a response to the limitations of logical structures. The role of computing power in the emergence of deep learning. Introduction of architectures for processing language and sequential data. Transformer models as the foundation of modern generative systems.

IW: Prepare an analytical review of the key technology that changed the development of AI.

Literature: Zhezherun, 2020; Goodfellow et al., 2016; Russell & Norvig, 2021.

Seminar 5

Topic 3. Logical models, algorithmic methods, and ways of representing knowledge in AI systems

Key questions: Formalisation of knowledge in the form of propositional structures. Predicate logic as a way of describing objects and relations. Production rules as a mechanism for building expert models. Semantic networks as graph structures of concepts. Frame models as structured templates for describing situations.

Assignment: Build a fragment of a knowledge base in the form of a logical or graph structure.

Literature: Zhezherun, 2020; Kovalchuk, 2022; Russell & Norvig, 2021.

Seminar 6

Topic 3. Logical models, algorithmic methods, and ways of representing knowledge in AI systems

Key questions: Logical operators and quantifiers as tools for formal knowledge description. Deductive inference procedures as consequence search algorithms. Limitations of production systems in complex environments. Using graph structures to represent relationships between concepts. Comparing logical and statistical models in classification tasks.

Assignment: Develop a logical description of the subject area and present it in the form of a set of rules.

Literature: Zhezherun, 2020; Kovalchuk, 2022; Russell & Norvig, 2021.

Seminar 7

Topic 4. Machine learning methods, modelling principles and types of training procedures

Key questions: Supervised learning as model parameter optimisation. Unsupervised learning as the discovery of structures and clusters in data. Features of regression and classification models. Criteria for the generalisability of models. The impact of data volume and quality on learning outcomes.

Assignment: Build a small classification or regression model and evaluate its quality.

Literature: Ovcharuk, 2021; Malik, 2020; Alpaydin, 2020.

Seminar 8

Topic 4. Machine learning methods, modelling principles and types of training procedures

Key questions: Choosing a model according to the type of task. Overfitting and mechanisms for detecting it. Using regularisation to stabilise models. Methods for splitting data into training and test subsets. Understanding model error and its interpretation.

Assignment: Perform regularisation for the selected model and compare the results before and after.

Literature: Ovcharuk, 2021; Malik, 2020; Alpaydin, 2020.

Seminar 9

Topic 5. Architecture of artificial neural networks and their training mechanisms

Key questions: Structure of a multilayer perceptron. The process of forward signal propagation. Activation functions and their impact on the model. The mechanism of backpropagation of error. Key parameters that determine the depth and complexity of the network.

IW: Build a diagram of a simple neural network and explain the role of each layer.

Literature: Goodfellow et al., 2016; Brovko, 2021; Chollet, 2021.

Seminar 10

Topic 5. Architecture of artificial neural networks and their learning mechanisms

Key questions: Stochastic gradient descent as a basic optimisation method. Modifications of optimisation algorithms and their impact on convergence speed. Exploding and vanishing gradients as a problem in deep networks. Features of convolutional architectures for image analysis. Use of recurrent networks for working with sequences.

IW: Analyse the impact of optimiser selection on the training process of a simple neural network.

Literature: Goodfellow et al., 2016; Brovko, 2021; Chollet, 2021.

Seminar 11

Topic 6. Methods of data collection, preparation, and technical analysis for AI systems

Key questions: Formation of training samples taking into account data structure requirements. Pre-processing such as cleaning, normalisation and feature transformation. Data balancing in classification tasks. Feature scaling as a condition for stable algorithm operation. Data quality assessment as a check of its suitability for modelling.

IW: Select a raw data set and perform the cleaning and normalisation steps.

Literature: Ovcharuk, 2021; Malik, 2020.

Seminar 12

Topic 6. Methods of data collection, preparation, and technical analysis for AI systems

Key questions: Feature selection as a process of selecting relevant parameters. Construction of new features as feature engineering. Methods for detecting gaps and anomalies in samples. Distribution of data into training and test subsets. Analysis of correlations and structural dependencies between features.

IW: Analyse the features of the selected dataset and identify key parameters for the model.
Literature: Ovcharuk, 2021; Malik, 2020.

Seminar 13
Topic 7. Fundamentals of natural language processing and language model construction
Key questions: Tokenisation and lemmatisation as basic stages of text pre-processing. Text vectorisation as a transition to numerical representations. Statistical language models as an assessment of sequence probabilities. Neural language models as a means of constructing contextual representations. The use of language models in classification, generalisation and search tasks.
IW: Select a text fragment and perform tokenisation, lemmatisation and vectorisation.
Literature: Vasilyev, 2023; Jurafsky & Martin, 2023; Sebastiani, 2002.

Seminar 14
Topic 7. Fundamentals of natural language processing and language model construction
Key questions: Building models for working with sequences. Comparing classical statistical methods with neural approaches. Evaluating the quality of language models in prediction tasks. Problems of ambiguity and contextual dependence of text. Using large language models in applied applications.
IW: Compare the results of two different language models on the same text set.
Literature: Vasilyev, 2023; Jurafsky & Martin, 2023; Sebastiani, 2002.

Topic 8. Generative models, autoencoders, GANs, and GPT transformer models and their technical applications
Key questions: Autoencoder architecture and data compression principles. Variational autoencoders as generative models of latent spatial representations. Generative adversarial networks as the interaction between a generator and a discriminator. Transformer models as a self-attention mechanism for working with sequences. Applications of generative models in text and image synthesis and data structuring.
IW: Select one generative architecture and explain its mechanism of operation using a specific example of application.
Literature: Klymchuk, 2022; Goodfellow et al., 2016; OpenAI, 2023.

Seminar 15
Modular control work

6. Independent work

Independent work includes:
preparation for classroom sessions – 64 hours;
preparation for the Modular control work – 4 hours;
preparation for the test – 6 hours.
Total – 74 hours.

Policy and control

7. Policy of the academic discipline (educational component)

While studying the material of the academic discipline "Fundamentals of Artificial Intelligence", students complete assignments for seminars, write a Modular control work and take an oral exam (appendixes to the syllabus). These types of work help students consolidate and deepen their theoretical knowledge of specific topics in the module, develop skills for independent work with primary sources, and contribute to the formation of theoretical sociological thinking and imagination.

Attendance and completion of assignments

It will be difficult for students to properly prepare for practical classes and tests if they miss lectures. For students who wish to demonstrate excellent learning outcomes, active participation in lectures is essential. However, it is not necessary to make up for missed lectures.

Active participation in practical classes is mandatory. A student's rating will largely be based on the results of their work in practical (seminar) classes. Each missed practical class (regardless of the reason for the absence) lowers the student's final rating in the discipline.

Students who have missed practical classes can prevent their final rating from being lowered by studying the relevant topics in a timely manner (during the semester) and completing the assignments for the missed classes. There is no need to wait until the exam session to communicate with the teacher. This should be done as soon as the student is ready to demonstrate their knowledge and skills on the missed topics.

Topics and assignments for practical classes are provided in the syllabus, available from the student's personal account in the Moodle or Campus system.

Laptops and smartphones may be used during lectures and practical classes, but only for purposes related to the topic of the class and the relevant thematic task. It is not advisable to answer the teacher's questions by reading from the screen of a smartphone, laptop, textbook or notes. This does not reflect well on the student's level of preparation. Students' answers may be based on the materials at hand, but should not be read from the text.

Forms of work

Lectures and seminars are conducted in accordance with the requirements of regulatory and methodological documents and the student assessment rating system. Lectures use computer presentations highlighting the main points of the topics, taking into account the subject matter of the classes: from textbooks, teaching aids and dictionaries on sociology.

In seminars, students discuss primary source texts and professional commentary on their content. Seminars provide an opportunity to assess, on the one hand, the level of preparation for them (presentations, participation in discussions, expressing one's own opinion) and, on the other hand, to master the tasks of modular control. The results of the student's work are assessed by the teacher according to the current grading system and indicate the effectiveness of the student's work control. The criteria for assessing the performance of seminar tasks are: logical sequence of answers; completeness of each question; analytical reasoning in the answer; references to sources; validity of personal conclusions.

Procedure for appealing the results of assessment measures

Students have the opportunity to raise any issue related to the assessment procedure and expect it to be considered in accordance with pre-defined procedures. To appeal against an assessment, a student must submit a statement indicating the reason for the appeal and providing evidence of the teacher's bias. The teacher must discuss this application with the student in person during a consultation. If there is no agreement on the result of the assessment, a commission of teachers from the department is formed to evaluate the assessment procedure and the student's claims. The commission may decide to repeat the assessment or reject the application. The commission's decision is final and cannot be appealed.

University policy

Academic integrity

The policy and principles of academic integrity are defined in Section 3 of the Code of Honour of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". For more details, see: https://kpi.ua/code. (other necessary information regarding academic integrity).

Standards of ethical conduct

The standards of ethical conduct for students and employees are defined in Section 2 of the Code of Honour of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". For more information, please visit: https://kpi.ua/code.

Artificial intelligence policy

The policy on the use of artificial intelligence and its principles are regulated by the order "Policy on the use of artificial intelligence for academic activities at Igor Sikorsky Kyiv Polytechnic Institute". For more details, see: https://osvita.kpi.ua/node/1225.

8. Types of control and the learning outcomes assessment rating system (LOAS)

Assessment and control measures

A student's grade in a discipline consists of points awarded for:

1. answers, problem solving, and additions to other students' answers during discussions in seminars;
2. completion of the Modular control work.

A student receives the highest rating if they actively participate in seminars, mainly provide complete and reasoned answers, present them logically, express their own position on discussion issues, and present it clearly and logically.
Proper preparation for a practical class will take an average of 1.5-3 hours.
The lecturer assesses the student's work at each practical class. The final number of points for work in practical classes is posted by the lecturer on the electronic campus.

1. Work in seminars is assessed on a scale of up to 5 points.
The maximum number of points for all practical classes is rsem = 5 points * 15 = 75 points.
Assessment criteria:

"Excellent" 5 points – the student receives this grade when answering most of the questions in the seminar class. An answer is considered complete if the student demonstrates a deep knowledge of the material, presents it logically and consistently, gives reasoned conclusions, freely uses specific data, provides mostly complete and reasoned answers, expresses their own position on controversial issues, and demonstrates signs of theoretical thinking and sociological imagination.

"Good" 4 points – the student participates in the discussion of individual issues of the seminar plan, demonstrates a good level of knowledge of the material.

"Satisfactory" 3 points – the student participates in the discussion of one issue on the seminar plan or demonstrates rather superficial knowledge, does not express their own position on the issues under discussion.

"Unsatisfactory" – no answers – 0-2 points.

2. Modular control work
The MCW involves writing an essay on one of the topics listed in Appendix 1.
Weighting – 25 points.
The essay is assessed according to the following criteria:
"excellent" – 22-25 points – the student formulates accurate definitions, provides theoretically sound arguments on the topic of the essay, and demonstrates their own reasoned position;
"good" – 18-21 points – the essence of the topic is reflected, but there are inaccuracies in the answer;
"satisfactory" – 15-17 points – incomplete answer, significant errors present;
"unsatisfactory" – 0-14 points – incorrect answer.

3. Bonus points
A total of no more than 10 points for the following types of work:
– for research activities (participation in conferences, student competitions, publications);
– participation in faculty competitions in the discipline and all-Ukrainian competitions.

The rating assessment for the academic discipline is communicated to applicants during the examination session.
Applicants with a rating of 60 points or more receive a grade corresponding to their rating without additional tests.
For applicants with a rating of less than 60 points, as well as those who wish to improve their rating, the teacher conducts a semester assessment in the form of a test or interview.

4. Credit.
Weighting score – 100.
The credit takes the form of a list of questions that the student must answer. The questions vary in content and correspond to the topics of lectures, seminars, independent work, and self-assessment questions.

Assessment criteria
95-100 points - the student demonstrates a deep knowledge of the content of the course material, the ability to systematically and interdisciplinarily analyse the issues covered in the course; freely and correctly uses scientific concepts and terms, formulates logical, reasoned conclusions, and expresses their own well-founded position on controversial issues;

85-94 points - the student demonstrates a very good level of mastery of the course material, is well versed in the main topics of the course, is capable of analysis and generalisation; there may be isolated inaccuracies in formulations or examples that do not significantly affect the overall level of the answer;
75-84 points - the student demonstrates a fairly complete understanding of the main topics and issues of the course. Uses basic scientific terminology, but the analysis is mainly descriptive; conclusions are formulated, but not always sufficiently substantiated;
65-74 points - the student demonstrates a general understanding of the course material, but the answers contain noticeable inaccuracies in definitions, examples or logic of presentation; the use of scientific terminology is limited, the analytical component is weak;
60-64 points - the student demonstrates fragmentary knowledge of individual topics of the course, is familiar only with some of the key concepts; answers are incomplete, superficial, conclusions are insufficiently substantiated or absent;
0-59 points - the student is not familiar with the key concepts and issues of the course, demonstrates superficial or chaotic knowledge; lacks analytical thinking and the ability to apply the knowledge gained; answers are illogical or incomplete.

Conditions for a positive interim assessment:
To receive a "pass" on the first interim assessment, the student must have at least 10 points; to receive a "pass" on the second interim assessment, the student must have at least 20 points.

Conditions for admission to the exam:
The condition for a student's admission to the exam is the completion of the Modular control work.

Table of correspondence between rating points and grades on the university scale:

Rating of the applicant (points)	*University scale of grades for the level of acquired competencies (learning outcomes)*
100-95	Excellent
94	Very good
84	Good
74-65	Satisfactory
64-60	Sufficient
Less than 60	Unsatisfactory

Possible marks in the semester control report:

Not admitted	Failure to meet the conditions for admission to semester control
Removed	Violation of the principles of academic integrity or moral and ethical standards of conduct
Did not appear	The applicant was admitted but did not appear for the exam

9. Additional information on the discipline (educational component)

Recommendations for students

During lectures, students should take notes on the main concepts, characteristics, classifications, definitions, and algorithms discussed by the lecturer. This will allow students to better present their position (opinion), critically evaluate the positions (opinions) of other students, and ask questions to the lecturer and other students. This will increase the amount of material learned and the depth of understanding. When preparing for a practical class, it is advisable for students to study the lecture material on a specific topic and

familiarise themselves with additional resources in the bibliography. If a student has not familiarised themselves with the educational material, they should listen more carefully to the speakers and try to compensate for their lack of preparation for the class with the information they receive. Students should not refuse to answer the teacher's questions. Even if a student does not know the answer, it is advisable to try to answer, express their opinion based on their own knowledge, experience, the logic of the question, etc. At the same time, there is no need to be afraid of making mistakes – one of the important tasks of studying social sciences and humanities is to develop skills of logical thinking, conducting discussions and expressing one's own opinions. However, it is worth remembering that ignorance of the subject material is a significant shortcoming in a student's work and will negatively affect their overall rating.

If a student misses classes for valid reasons, they can make up for the missed topics by writing creative essays.

Informal distance and online courses

At the request of the applicant, in conditions that do not facilitate regular attendance, it is permissible to study individual content-rich parts of the discipline in asynchronous mode, in particular through distance learning courses and other forms of informal learning. In order for the credits for such courses to be taken into account in the rating system, they must correspond in content to certain topics of the syllabus, and their completion must be agreed with the teacher of the discipline. To confirm completion of informal learning, the student must provide a relevant document (certificate) indicating the name of the courses and their duration in hours. Recognition of informal education results is carried out in accordance with the procedure set out in the relevant Regulations of Igor Sikorsky KPI: https://osvita.kpi.ua/node/179

It is also possible to use other mass open online or offline courses (in whole or in part) subject to agreement on their subject matter and content with the lecturer.

Distance learning

Synchronous distance learning is possible using video conferencing platforms and the university's educational platform for distance learning.

Inclusive learning

Permitted

The working programme of the academic discipline (syllabus):

Compiled by Associate Professor of the Department of Sociology, Doctor of Social Sciences, M.P. Kukhta.
Approved by the Department of Sociology (Minutes No. 14 of 23.06.2025)
Approved by the Methodological Commission of the Faculty (Minutes No. 4 of 24 June 2025)

Appendix 1.

Assignments for the Modular control work.
Writing an essay (up to 5 pages).
Topic of choice:

The essay topic is chosen by the student from the proposed list. The essay should demonstrate the students' ability to apply the concepts and tools covered in the course, as well as their ability to formulate a reasoned position and work with scientific sources. A mandatory requirement is the use of technical data analysis: a brief description of the selected open data set (Kaggle or other open data), basic indicators (frequencies, averages, distributions) or simple visualisation (diagram, table, graph).

The technical part should be a tool for justification, not a separate laboratory work.

Essay topics (choose one topic)

1. Analysis of users' digital attention on social networks based on open data
2. The impact of algorithmic recommendations on user choices on digital platforms based on simple data analysis
3. Emotional characteristics of online content and their connection to user engagement based on open text or media datasets

4. Manifestations of cognitive biases in users' digital behaviour based on the analysis of simple behavioural data

5. Human interaction with intelligent systems and new behavioural trends based on data on the use of ChatGPT models and similar agents

6. Dynamics of online interactions and digital habits based on data on user activity on the network

7. The relationship between users' emotional state and content types on social platforms based on data from emotional or sensitive text sets

8. Features of e-commerce user behaviour and psychological factors in digital decision-making

9. Use of intelligent systems for domestic or professional purposes based on survey data or interaction logs

10. Comparison of the characteristics of popular online content and low-visibility content based on open data about posts, videos or comments

The essay should be formatted in accordance with DSTU requirements and standards for written works

- Times New Roman font, size 14;
- line spacing 1.5;
- paragraph indentation 1.25 cm;
- margins: left 30 mm, right 20 mm, top 20 mm, bottom 20 mm;
- the text is aligned across the width;
- page numbers are in the upper right corner without a period.

Essay structure

The essay should contain the following elements:

- Introduction
  Formulated topic, purpose of the work, outline of the problem.
- Main part
  An analytical presentation that includes: – interpretation of the technical element (data analysis),
  – explanation of the mechanisms tested by the student,
  – argumentation based on data and literature.
- Conclusions (generalisation of results, formation of the student's position)
- List of sources used (formatted according to DSTU 8302:2015).

Requirements for the technical part

The student must:

- select one open data set (Kaggle / open data);
- briefly describe it (3–4 sentences);
- perform one simple statistical operation (frequency, mean, comparison of groups);
- submit one visualisation or table, labelled as "Fig. 1 ..." or "Table 1 ...";
- interpret the results within the scope of the essay topic.

The technical part *is not separated* from the text — it is part of the argumentation. References are given in square brackets:

- for printed sources: [3, p. 15],
- for electronic sources: [4], without specifying pages.

The volume is up to 5 pages of the main text (without the list of references, figures and tables).

Appendix 2.

Questions for the exam

1. The concept of artificial intelligence and the main characteristics of intelligent systems.
2. Classification of AI systems according to operating principles and functional capabilities.
3. The concept of an agent and environment in the structure of an intelligent system.
4. Types of tasks solved by artificial intelligence systems.
5. Fundamentals of logical models used in the construction of AI systems.
6. Principles of algorithmic search for solutions in state space.
7. Basic methods of knowledge representation and their role in the modelling process.
8. The structure and properties of decision trees in the context of intelligent systems.
9. The concept of machine learning and its key components.

10. Differences between supervised and unsupervised learning.
11. Typical regression, classification, and clustering tasks.
12. Sample formation and the concept of features in machine learning.
13. The problem of model overfitting and ways to reduce it.
14. The purpose of activation functions in neural networks.
15. The main stages of the neural network training process.
16. The structure of a multilayer perceptron and how it works.
17. Differences between shallow and deep neural network architectures.
18. Preparing data for modelling and the importance of normalisation.
19. Working with missing values and methods for processing them.
20. Principles of dividing a sample into training and testing parts.
21. Tokenisation as a basic operation in text data processing.
22. Stemming and lemmatisation and their role in text normalisation.
23. The purpose of TF-IDF and its capabilities in text analysis.
24. Basic principles of building vector models of words.
25. The logic of autoencoders and their areas of application.
26. The basic principle of generative adversarial networks.
27. Structural features of transformer models.
28. General logic of GPT models and their limitations.
29. Risks of using modern artificial intelligence models.
30. Main areas of AI application in research, education and social practices.