“Халықаралық ақпараттық технологиялар университеті” АҚ

АО “Международный университет информационных технологий”

Faculty of Computer Technology and Cybersecurity

Department of Computer Engineering

«APPROVED»

Dean of faculty

_____ N.A. Seilova

«29» 08 2025

WORKING CURRICULUM OF THE DISCIPLINE (SYLLABUS)

Course: SFT6322 Introduction to Artificial Intelligence

Group of educational programs: 6B06110 Software Engineering

Educational program: B057 Information technologies

Year: 2 **Semester:** 1 **Number of academic credits**: 5 ECTS

Lectures:	15	hours
Laboratory work:	30	hours
IWST:	15	hours
IWS:	90	hours
TOTAL:	150	hours
Cycle of discipline:	Basic	
Form of control:	Project	

Almaty 2025

The working curriculum of the discipline (syllabus) SFT6322 Introduction to artificial intelligence has been developed on the basis of the educational program B057 Information technologies.

The working curriculum of the discipline (syllabus) has been reviewed at the meeting of Computer Engineering department.

Minutes № 21 **dated «** 04 **»** 06 **20**25

Head of the Department _____ PhD, Associate prof., Bykov A.A.

Author _____ Msc, Senior lector, Tleuova G.N.

The working curriculum of the discipline (syllabus) was approved at a meeting of the Faculty's Academic Quality Council.

Minutes № 1 **dated "**09**"** 08 **20**25

Agreed:

Head of the Department of the Educational and Methodological activities _____ **Ajibayeva A.**

Library _____ Шаженова Л.5

(Full name and position)

1. General information	
Faculty	Computer Technology and Cybersecurity
Code and name of the educational program (EP)	B057 Information technologies
Program level (bachelor's, master's, PhD)	Bachelor
Year, semester	2,1 semester
Name of the discipline	Introduction to artificial intelligence
Cycle of the discipline	Basic
Number of academic credits	5
Prerequisites	Linear algebra,probability and statistics,discrete mathematics
Postrequisites	Machine learning,Deep learning, Natural Language Processing
Lecturer	Tleuova G.N. E-mail: g.tleuova@iitu.edu.kz Room 409, IITU, Almaty, Kazakhstan
Teachers who conduct practical or laboratory classes	Tleuova G.N. E-mail: g.tleuova@iitu.edu.kz Room 409, IITU, Almaty, Kazakhstan

2. Goals, objectives and learning outcomes of the course

Course goals

The goal of this course is to introduce students to the fundamental principles, techniques, and applications of Artificial Intelligence (AI). The course aims to develop a strong conceptual understanding of how intelligent systems are designed, implemented, and evaluated.

Course objectives:

- Understand the history, scope, and various domains of Artificial Intelligence.
- Describe the core concepts and techniques used in AI, such as problem-solving, search algorithms, knowledge representation, and reasoning.
- Explain the role of machine learning in modern AI systems.
- Analyze and implement basic AI algorithms.
- Explore real-world applications of AI in fields such as robotics, natural language processing, and expert systems.
- Discuss the ethical and societal implications of AI technologies.

Learning outcomes

After successful completion of the course, students will be able to:

- Define key terms and concepts related to Artificial Intelligence.
- Explain and apply search strategies (e.g., uninformed, informed, adversarial search) to solve computational problems.
- Design simple AI models using rule-based systems and logic programming.
- Represent knowledge using appropriate frameworks such as propositional and predicate logic.
- Analyze machine learning models and understand their role within the broader AI ecosystem.
- Apply AI techniques to solve basic real-world problems in various domains.
- Critically evaluate AI systems from a technical and ethical standpoint.
- Communicate AI concepts effectively in both technical and non-technical contexts.

As a result of mastering the discipline Introduction to Artificial Intelligence, students will acquire competencies in:

- Understanding and applying fundamental AI concepts, including intelligent agents, search

algorithms, and knowledge representation methods.
- Designing and implementing basic AI algorithms for problem-solving, decision-making, and logical reasoning in computational systems.
- Analyzing and comparing AI methods in terms of efficiency, suitability, and limitations for various types of problems.
- Utilizing foundational machine learning approaches and recognizing their role within broader AI systems.
- Applying AI techniques to real-world scenarios such as natural language processing, expert systems, and robotics.
- Evaluating the ethical, legal, and social implications of AI technologies, including considerations of bias, transparency, and responsibility.
- Working collaboratively on AI-related projects, demonstrating problem-solving, critical thinking, and effective communication skills.

3. Course description

Course Description: This course lays a solid foundation for understanding and developing intelligent systems, providing students with the conceptual and practical tools required to explore the rapidly evolving field of Artificial Intelligence. Students will study large AI-based systems and how they are decomposed into components such as perception, reasoning, learning, and action. Emphasis is placed on how these components interact and how their integration influences performance, scalability, and ethical considerations.

Students will engage with key AI paradigms—including symbolic reasoning, machine learning, and probabilistic models—while gaining experience with tools and formalisms that guide the design of intelligent behavior. The course also highlights the relationship between AI system structure and essential attributes such as explainability, fairness, and robustness.

Throughout the course, students will examine the distinctions between core AI algorithms and higher-level system architectures, along with the methodologies used for evaluation and improvement. Two significant AI applications are analyzed in depth to illustrate how architectural choices and algorithmic strategies impact effectiveness and risk. The course also addresses the role of data, model transparency, and deployment challenges in real-world AI systems.

4. Teaching methods

Teaching methods: The course employs a balanced blend of theoretical instruction and experiential learning to ensure that students gain both foundational knowledge and practical skills in Artificial Intelligence. The teaching strategy incorporates the following methods:

- **Lectures** – to introduce core AI concepts, including search algorithms, knowledge representation, machine learning, and neural networks.
- **Laboratory classes and hands-on workshops** – to provide practical experience with AI tools and frameworks (e.g., Python, scikit-learn, TensorFlow), allowing students to implement and test basic AI algorithms.
- **Interactive discussions and case studies** – to promote critical thinking, ethical reasoning, and the analysis of real-world AI applications in fields such as healthcare, finance, and robotics.
- **Project-based learning** – students progressively develop a small AI-based system or component, applying the knowledge acquired during lectures and labs to solve a concrete problem.
- **Digital and innovative tools** – use of programming environments (e.g., Jupyter Notebooks, Google Colab), online learning platforms (MS Teams, Moodle), and visualization tools to support experimentation and collaboration.
- **Self-study assignments** – designed to reinforce theoretical understanding, support

algorithmic thinking, and develop independent coding and research skills.
This integrated approach aims to cultivate both technical and analytical competencies, preparing students for further study or entry-level work involving the design, evaluation, and ethical use of AI systems.

5. Course policy

Attendance Policy: If the absence rate is more than 20%, the student will automatically receive an F

Deadline Policy: All laboratory and independent assignments must be submitted strictly by the deadlines specified in this syllabus. Submissions are to be made through the Platonus system, which records the final submission date. Late submissions will not be reopened for resubmission.

Late Submission Policy: If a student uploads an assignment on time but fails to complete the defense within the required timeframe, 10 points will be deducted from the grade.

Resubmission Policy: If a student is required to defend an assignment for a second time, 15 points will be deducted from the grade.

Academic Conduct and Ethics Policy:

- Arriving more than 5 minutes late to class may be recorded as an absence.
- If a student disrupts the learning process (e.g., excessive talking, inappropriate use of mobile devices), the instructor has the right to remove the student from the classroom.
- The use of unauthorized materials and plagiarism is strictly prohibited. Any violation will result in an automatic grade of "F" for the assignment.
- Students must adhere to the principles of academic integrity and demonstrate respect toward both the instructor and their peers.

Respect for Differences of Opinion: The course encourages open expression of ideas and perspectives. Students are expected to respect differing viewpoints, engage in discussions in a constructive manner, and avoid offensive or discriminatory remarks.

Communication and Ethics of Interaction:
All course-related inquiries outside class hours must be addressed through the MS Teams platform. Communication should remain professional, respectful, and relevant to the subject matter.

Inclusion and Individual Needs Policy: This course is committed to inclusive practices. The instructor will take into account students' individual learning needs (e.g., medical or social circumstances) when providing materials and organizing the learning process. Students are encouraged to notify the instructor in advance if special accommodations are required, so that appropriate arrangements can be made.

6. Academic Integrity

- Plagiarism and other violations policy

Plagiarism, fabrication of results, falsification of data, or the use of unauthorized materials during assignments and project work are strictly prohibited.

- Any detected plagiarism (copying diagrams, code, or written work from external sources or peers without proper citation) will result in a grade of "F" for the respective assignment.
- Repeated violations may lead to disciplinary action in accordance with university regulations.
- Students are expected to produce original diagrams, design models, and documentation

reflecting their own work.

- Code of academic integrity

This course follows the principles of academic honesty, responsibility, and respect:

1. Honesty – All assignments, laboratory work, and project documentation must be the student's own work.
2. Fairness – Students must respect deadlines, assessment rules, and the grading system.
3. Respect – Students should engage in academic discussions respectfully, valuing diverse perspectives.
4. Responsibility – Each student is responsible for contributing to group tasks (if assigned) and for maintaining high standards of professional conduct.
5. Ethical conduct – Cheating, unauthorized collaboration, or attempts to gain unfair advantage are strictly forbidden.

Violation of the Code of Academic Integrity will result in penalties up to and including an automatic "F" for the course.

- Use of AI - conditions must be written (use of AI is permitted only within the limits defined by the teacher)

The use of Artificial Intelligence (AI) tools (such as ChatGPT, Copilot, diagram generation software, etc.) is permitted only under the following conditions:

- AI may be used for assistance in brainstorming, idea structuring, and drafting documentation but must not replace the student's independent work.
- All diagrams, architectural models, and project deliverables must be created and finalized by the student.
- If AI tools are used, the student must clearly indicate in the report which parts were supported by AI.
- Submissions entirely or largely generated by AI without student adaptation or contribution will be considered academic misconduct and evaluated as plagiarism.
- The instructor reserves the right to define additional limitations on the use of AI for specific assignments.

7. Literature

Basic literature:

1. Jones, S. Stephan, Artificial Intelligence and Machine Learning for Business for Non-Engineers : учебное пособие / S.Stephan Jones, M.Frank Groom. - USA : CRC Press, 2020. - 147 c. - ISBN 978-0-367-36574-5.

2. Sandro, Skansi, Introduction to Deep Learning: From Logical Calculus to Artificial Intelligence = Undergraduate Topics in Computer Science / Skansi Sandro. - Germany : Springer, 2018. - 343 p. - ISBN 978-3319730035.

3. Yampolskiy, V. Roman, Artificial Intelligence Safety and Security : учебное пособие / V.Roman Yampolskiy. - USA : CRC Press, 2019. - 443 c. - ISBN 978-1-138-32084-0.

Supplementary literature:

1. **Amini, M.** AI Crash Course: A fun and hands-on introduction to machine learning, reinforcement learning, deep learning, and artificial intelligence with Python / M. Amini. — No Starch Press, 2020.

2. **Chollet, F.** Deep Learning with Python (2nd ed.) / F. Chollet. — Shelter Island: Manning Publications, 2021.

Publications, 2021.

3. **Domingos, P.** The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World / P. Domingos. — Basic Books, 2015.

4. **Mitchell, M.** Artificial Intelligence: A Guide for Thinking Humans / M. Mitchell. — Farrar, Straus and Giroux, 2019.

5. **Zhou, Z.-H.** Machine Learning / Z.-H. Zhou. — Springer, 2021.

6. **Nilsson, N. J.** The Quest for Artificial Intelligence: A History of Ideas and Achievements / N. J. Nilsson. — Cambridge University Press, 2009.

Online resources:

1. **Elements of AI** – A free online course on Artificial Intelligence developed by the University of Helsinki.
2. **Introduction to Artificial Intelligence (edX – Columbia University)** – Covers the theory and practice of fundamental AI concepts.
3. **Machine Learning (Coursera – Andrew Ng, Stanford University)** – One of the most popular online courses on machine learning, taught by Stanford professor Andrew Ng.
4. **Deep Learning Specialization (Coursera)** – A series of courses on deep learning offered by deeplearning.ai, covering neural networks, CNNs, RNNs, and more.
5. **Fast.ai** – A practical, hands-on deep learning course focused on real-world applications and rapid development.

8. Forms of control and assessment

№	Type of Work	Form of Control	Evaluation Criteria
1	Continuous Assessment 1: Laboratory Works №1 - №4	Problem-solving tasks	Correctness of algorithm implementation; understanding of basic AI concepts (search, logic, agents); appropriate use of AI tools and programming libraries.
2	Mid-term: Part of the Project	Oral defence Project presentation/report	Theoretical knowledge of AI principles; ability to explain and justify algorithmic choices; accuracy and creativity in applying AI methods to a selected problem.
3	Continuous Assessment 2: Laboratory Works №6 - №10	Laboratory/class assignments	Correct implementation of AI algorithms (e.g., decision trees, classifiers, neural networks); correct use of development tools (e.g., Python, scikit-learn); meeting assignment objectives.
4	End-of-term: Test/ open questions on topics covered	Oral defence	Application of AI methods to solve real-world problems; justification of selected algorithms and models; understanding of ethical and practical implications.
5	Independent Student Work (ISW) (List of topics in Table 9)	Oral defence	Depth of analysis; originality in problem formulation and AI approach; correct application of AI techniques and evaluation metrics.
6	Final Assessment	Project work	Comprehensive understanding of AI course content; ability to implement, evaluate, and explain AI solutions; critical thinking in model selection and performance interpretation (see Section 14).

9. System for evaluating student performance in a discipline:

Each type of academic work is assessed on a 100-point scale in accordance with the table. Example

Period	Assignments	Score
1st attestation	Laboratory works 1,2,3,4,5	100
	Continuous assessment 1	100
	ISW 1	100
	ISW 2	100
	Mid-term	100
2nd attestation	Laboratory works 6,7,8,9,10	100
	Continuous assessment 2	100
	ISW 3	100
	ISW 4	100
	End-of-term	100
	Exam	
TOTAL	**0,3*1Ат+0,3*2Ат+0,4*Ex.**	

10. Course schedule

Week/ date	Course topics	References	Lectures (h/w)	Lab. sessions (h/w)	IWST (h/w)	IWS (h/w)
Week / Date	**Course Topics**	**References**	**Lectures (h/w)**	**Lab. Sessions (h/w)**	**IWST (h/w)**	**IWS (h/w)**
1.	Introduction to AI. History and Applications of AI	BL, SL	1	LW1	Project 1	Assigned readings
2.	Problem Solving and Search (Uninformed)	BL, SL	1	LW1	Project 1	Project 1
3.	Informed Search and Heuristics	BL, SL	1	LW2	Project 1	Project 1
4.	Constraint Satisfaction Problems	BL, SL	1	LW3	Project 1	Project 1
5.	Adversarial Search (Games and Minimax)	BL, SL	1	LW3	Project 2	Project 2
6.	Machine Learning Overview: Supervised Learning	BL, SL	1	LW4	Project 2	Project 2
7.	Machine Learning: Decision Trees, k-NN	BL, SL	1	LW5	Project 3	Project 3
8.	**Mid-Term Assessment**	BL, SL	1	Mid-term	Project 2	Project 2

9.	Neural Networks and Deep Learning Basics	BL, SL	1	LW6	Project 3	Project 3
10.	Unsupervised Learning: Clustering	BL, SL	1	LW7	Project 3	Project 3
11.	Natural Language Processing (NLP)	BL, SL	1	LW8	Project 4	Project 4
12.	Ethics and Social Impacts of AI	BL, SL	1	LW9	Project 4	Project 4
13.	Model Evaluation and Performance Metrics	BL, SL	1	LW10	Project 5	Project 5
14.	Validation Metrics in ML	BL, SL	1	LW10	Project 5	Project 5
15	**End-Term Assessment**	BL, SL	1	End-term	Project 6	Project 6
Total hours:			**15**	**30**	**15**	**90**

11. List of topics/assignments for laboratory classes

№	Topic Title	Number of Hours	References	Form of Reporting	Deadline
1.	History and Evolution of AI	4	BL, SL	Report	Week 2
2.	Intelligent Agents and Environments	2	BL, SL	Report	Week 3
3.	Problem Solving with Search Algorithms	4	BL, SL	Report	Week 5
4.	Constraint Satisfaction Problems in AI	4	BL, SL	Report	Week 7
5.	Basics of Machine Learning Algorithms	2	BL, SL	Report	Week 8
6.	Supervised vs. Unsupervised Learning	2	BL, SL	Report	Week 9
7.	Introduction to Neural Networks	2	BL, SL	Report	Week 10
8.	AI in Natural Language Processing	3	BL, SL	Report	Week 11
9.	Ethics and Fairness in AI	3	BL, SL	Report	Week 12
10.	Model Evaluation Metrics in Machine Learning	4	BL, SL	Report	Week 14 Week 15

12. List of topics/assignments for student's independent work

Proper organization of students' independent work is the key to the formation of skills in mastering, learning, assimilation and systematization of acquired knowledge, ensuring a high level of academic performance in the learning process.

№	Topic/Assignment Title	Number of Hours	References	Form of Reporting	Deadline
1	**Working with literature** – – Reading and summarizing AI textbooks, articles, and ethical guidelines – Preparing a literature review on AI topics – Annotating scientific publications on machine learning and neural networks	15	[1]–[3]	Oral defence	Next lecture
2	**Solving practical tasks** – Performing exercises on AI algorithms (search, classification, etc.) – Solving AI-related case studies – Developing simple programs using AI libraries (e.g., scikit-learn, TensorFlow)	15	[1]–[3]	Oral defence	Next lecture
3	**Analytical activities** – Analyzing real-world AI applications – Creating comparative tables and diagrams for algorithms or models – Conducting mini-research and writing short analytical reports	15	[1]–[3]	Oral defence	Next lecture
4	**Project work** – Preparing a presentation on an AI topic (e.g., NLP, computer vision) – Developing a mini AI-based project or prototype – Completing a creative task (e.g., chatbot, image classifier)	15	[1]–[3]	Oral defence	Next lecture
5	**Preparation for classes and knowledge assessment** – Making questions and answers on AI concepts – Creating a mind map or cheat sheet for exam prep – Reviewing and reflecting on previous mistakes in assessments	15	[1]–[3]	Oral defence	Next lecture
6	**Online activities** – Participating in forums or discussions about AI ethics, tools, and innovations – Working with e-learning platforms (e.g., Coursera, edX) – Completing online quizzes, tests, or programming challenges	15	[1]–[3]	Oral defence	Next lecture

13. Assessment criteria

The point-rating letter system for assessing the educational achievements of students with their interpretation in the traditional grading scale:

Letter system assessment	The digital equivalent of points	Percentage content	Traditional system assessment	General description of grading criteria
A	4,0	95-100	Excellent	The student has knowledge of the subject in the full scope of the curriculum, understands the discipline deeply enough; shows a high level of knowledge that exceeds the volume provided by the syllabus, gives an exhaustive answer
A-	3,67	90-94		The student has knowledge of the subject in the full scope of the curriculum, understands the discipline deeply enough; gives an exhaustive answer
B+	3,33	85-89	Good	The student shows a complete, well-founded knowledge of the subject, but the answers did not always highlight the main idea, rational methods of calculation were not always used; the answers were mostly brief and sometimes unclear.
B	3,0	80-84		
B-	2,67	75-79		
C+	2,33	70-74		
C	2,0	65-69	Satisfactory	The student demonstrates sufficient knowledge of the subject, but without proper depth and justification, the answers are unclear and without proper logical sequence.
C-	1,67	60-64		
D+	1,33	55-59		
D	1,0	50-54		
FX	0,5	25-49	Unsatisfactory	The student demonstrates insufficient knowledge of the subject, positive answers were not given to individual questions.
F	0	0-24		The student demonstrates a very low level of knowledge of the subject.

14. Assessment and evaluation materials (exam questions) Project

Each student (or team) must complete a comprehensive **AI system prototype and documentation package** for their final project. The project should demonstrate the student's ability to apply core AI methods and document their design and development process clearly and professionally. The final deliverables must include:

1. **Problem Definition and Goal Statement**
   – Clearly define the AI problem being addressed (e.g., classification, prediction, NLP, etc.).
   – State the project's objectives and expected outcomes.
2. **Data Collection and Preprocessing Plan**
   – Describe the dataset(s) used, including sources, formats, and relevance.
   – Provide details of data cleaning, transformation, and feature engineering.
3. **Algorithm and Model Selection**
   – Justify the choice of AI techniques used (e.g., decision trees, neural networks, clustering).
   – Discuss alternatives considered and explain model selection criteria.
4. **System Architecture Diagram**
   – Present a high-level architecture of the AI system, showing key components (e.g., data flow, model, APIs, front-end/backend, etc.).
5. **Implementation Overview**
   – Describe tools, frameworks, and programming languages used (e.g., Python, scikit-learn, TensorFlow, Jupyter).
   – Include code snippets or screenshots demonstrating key functionalities.
6. **Model Training and Evaluation**
   – Report model performance metrics (e.g., accuracy, precision, recall, F1 score, confusion matrix).
   – Include validation strategy (e.g., cross-validation, train-test split).
7. **Interpretability and Visualization**
   – Provide visualizations of model behavior, decision boundaries, or feature importance.
   – Include explainability techniques if applicable (e.g., SHAP, LIME).
8. **Ethical Considerations and Limitations**
   – Address fairness, transparency, and potential biases in data or algorithms.
   – Discuss any ethical implications or risks associated with the AI application.
9. **Deployment Plan (Optional)**
   – If applicable, describe how the AI system could be deployed (e.g., REST API, cloud service).
   – Include basic UI/UX sketches or interaction
10. **Final Report & Presentation**
    – Submit a well-structured report that outlines the entire project process: from problem analysis to model implementation and testing.
    – Present the project, including live demonstration or recorded walkthrough, and be prepared to defend design choices during the oral examination.

The final project must reflect a real-world or research-based AI application relevant to the student's area of interest or diploma topic. It should demonstrate a practical understanding of AI concepts, technical implementation skills, and the ability to communicate findings clearly in both written and oral formats.

Evaluation Criteria

Criterion	Description	Max Points
Completeness	All required project components are included (problem statement, dataset, model, evaluation, etc.) and aligned with the selected AI application.	20
Correctness	Implementation is technically accurate; AI methods and algorithms are applied appropriately; code and results are valid.	20
Consistency	Project components (data, model, metrics, explanation) are logically coherent and do not contradict one another.	15
Clarity & Design	Code, diagrams, and documentation are well-organized, readable, and follow clear structure and conventions.	10
Justification	Report and presentation clearly explain the choice of AI techniques, model selection, and evaluation methods.	15
Creativity & Realism	Originality and innovation of the problem or solution; project demonstrates relevance to real-world applications.	10
Presentation	Oral defense of the project; ability to explain AI processes, justify decisions, and respond to questions.	10
Total		**100**

15. Introducing students to the syllabus

I have read and agree with the requirements of the discipline « Introduction to Artificial Intelligence».

№	Full name of the student	Signature	Date
1.			
2.			
3.			
4.			
5.			
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9.			
10.			
11.			
12.			