**Abstract of the working program of discipline**

**--.--.--.- "Intelligent systems"**

**Direction of education:** --.--.02 "Fundamental Informatics and information technologies"

**Provisioning profile:** "Intelligent data processing"

**Graduate qualification:** master

**1. The goal and objectives of the discipline (module)** are to study qualitative characteristics of problems in the field of artificial intelligence (AI) as a domain automation approach, a classification of the problems according to criteria; study of methods of solving AI-problems, depending on the class in the classification; familiarization with existing software that implements AI methods, as well as implementation of AI components in the existing software.

**Objectives of the course** are to give students the classification of tasks of artificial intelligence, methods for their solutions and software to teach how to discover such tasks among production tasks that require automation with AI methods; to teach developing and implement algorithms that realize methods of artificial intelligence, including programs implementing games with complete information, solving problems; improve skills of logical thinking; proving program correctness, i.e., completeness and termination.

**2. Requirements to mastering the discipline (module):**

The process of the subject study aimed at formation of the following competences:

* ability to use and apply in-depth theoretical and practical knowledge in fundamental computer science and information technology (MIC-3);
* the ability to acquire and use in practice new knowledge and skills, including new areas of knowledge not directly associated with the scope of activities to broaden and deepen their scientific ideology (DIC-4);
* ability to conduct research and produce new scientific and applied results individually or as member of a research team (PC-1);
* the ability to use advanced theoretical and practical knowledge in the field of information technology and applied mathematics, fundamental concepts and system methodologies, international and professional standards in the field of information technologies (PC-2).

As a result of the discipline studying, the student's skills must conform to the following requirements

1. ***Scientific knowledge -*** the basic fundamental concepts underlying the high-level information processing technologies in the field of artificial intelligence, tools for the development of such systems; methods of increasing the efficiency of the computational algorithms, as well as be able to conduct analysis and data mining.
2. ***Applied knowledge and skills -*** design and analyze programs, representing optimization and combinatorial algorithms, procedures of information processing on the basis of formalized knowledge; developing knowledge bases for expert systems; carry out basic analysis and synthesis of data to identify patterns in data, interpreting the results of generalizations.
3. ***Master*** methods of construction, implementation, improving the efficiency of artificial intelligence algorithms, methods of narrowing a search scope in a search and combinatorial algorithms, software tools for developing expert systems.

**3. Time distribution of discipline and training activities divided by type of training**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of academic work** | **Total hours / credits** | **Semesters** | |
| 1 | 2 |
| **Classroom training (total)** | 86 | 46 | 40 |
| Lectures | 32 | 14 | 18 |
| Practical exercises (PE) | 46 | 28 | 18 |
| Laboratory works (LW) | 0 | 0 | 0 |
| Control of individual work (CEB) | 8 | 4 | 4 |
| **Individual work (total)** | 130 | 62 | 68 |
| Individual work (IW) | 103 | 62 | 41 |
| Methods of intermediate certification (exam) | 27 | 0 | 27 |
| The total complexity hours  credits | 216 | 108 | 108 |
| 6 | 3 | 3 |

**4. The content of the discipline**

* 1. Theme 1. **Introduction to AI on the example of solving problems.**

Introduction. AI problems, the types of information processing. Classification of problems of artificial intelligence. Knowledge representation, formalisms of knowledge representation. The concept of “action planning”, a valid state, the valid transitions from a state to a state, goals, etc. The State space graph. Search strategies without additional information. search strategies using additional information. The concept of fines and cost of the solution, heuristics. The heuristic search. A\* algorithm. Other problem solving algorithms. Representaion problems using subproblems. The concept of tasks and subtasks. And-OR graphs. CSP-problems. Another problem solving algorithms. The heuristic evaluation function. Methods of devising of the heuristic functions.

Theme 2. **The game problems.**

Game. The representation of positional games with coplete information. The evaluation functions. The MiniMax Algorithm. Alfa-beta pruning. The MiniMax tree traversal in depth. The concept of the horizon. Narrowing the area of search using alpha-Beta pruning.

Theme 3. **Expert systems. The architecture of the expert system.**

Expert systems. The architecture of the expert system. Classification of expert systems. The principles of machine inference implementation in expert systems. Pattern-directed programming. Knowledge representation in expert systems. Productions. CLIPS. Implementation of the subsystems of explanation of the inference made in an expert system. Knowledge engineering. The completeness of the knowledge base. Handling uncertainty in expert systems.

Theme 4. **Fuzzy logic. Fuzzy control system.**

The concept of an information-controlled system. Fuzzy logic. Fuzzy control system. Fuzzification and defuzzification. Logical-dynamical systems. The levels of intelligence of algorithms for control of logical-dynamic systems. Handling uncertainty in expert systems.

Theme 5. **Evolutionary computation.**

Evolutionary computing. Genetic algorithms. The ant algorithm, swarm optimization algorithm. Other discrete optimization algorithms. Gradient descent. Algorithms for continual improvement. Neural network. A formal neuron, its structure. Training neural networks. Perceptron. The algorithm of error back propagation.

**5. Form of intermediate control:** record 1 semester,<t2>, test 2nd semester.

**6. Developer of the annotation****:**

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