## ODESSA I.I. MECHNYKOV NATIONAL UNIVERSITY FACULTY OF MATHEMATICS, PHYSICS AND INFORMATION TECHNOLOGIES DEPARTMENT OF MATHEMATICAL SUPPORT OF COMPUTER SYSTEMS

Syllabus of the course "Fuzzy models and methods in intelligent systems"

Amount	the total number of: credits – 4; hours – 120; content modules - 2
Semester	autumn
Days, Time, Place	according to the class schedule
Teacher(s)	Vladislav Mykhaylenko, Doctor of Sciences (Tech.), Professor of the Department of Computer Systems and Technology
Contact phone number	0634531509
E-mail	Vladmihailen@gmail.com
Workplace	department of computer systems and technologies
Consultations	face-to-face consultations: Wednesday from 2:00 p.m. to 3:00 p.m. online consultations: ZOOM (link is generated at the beginning of classes)

#### COMMUNICATION

Communication with students will be carried out by e-mail, in the classroom or via ZOOM.

## COURSE ABSTRACT

**Subject** of the study of the course is the application of one of the methods of presentation and use of fuzzy knowledge in artificial intelligence systems based on fuzzy logic.

### Course prerequisites

The course material is based on previously acquired knowledge, practical skills and skills of the students on topics and areas related to algorithms, data structures, high-level programming languages, methods and systems of artificial intelligence.

#### Post-requisites of the course

This course is the basis for mastering the following disciplines of the educational and professional master's training program in the specialty 126 "Information systems and technologies": "Master's seminar", "Professional research practice", "Performance of master's qualification work".

Purpose of the course is the formation of:

- system knowledge regarding the principles of presenting and using fuzzy knowledge and knowledge bases, designing fuzzy models;
- practical skills in developing models in the FuzzyTECH package Course content

The course is based on the study of one of the ways of presenting and using fuzzy knowledge in artificial intelligence systems based on fuzzy logic. The basics of fuzzy logic and fuzzy sets introduced by Lutfi Zade are considered, models of fuzzy knowledge representation and logical inference are based on the use of linguistic variables. Mamdani, Sugeno models of fuzzy logical inference, fuzzy classification tasks, hierarchical systems of fuzzy logical inference, fuzzy controllers are studied. The practical implementation of the models is demonstrated on the example developed in the FuzzyTECH package and languages C#, Python.

#### **EXPECTED RESULTS**

As a result of studying the course, the student should know:

- fuzzy sets and membership functions;
- operations on fuzzy sets;
- basic methods of fuzzy modeling and algorithms of I. Mamdani and Tagaki-Sugeno;
- the main stages of developing fuzzy product systems;
- stages of creating fuzzy expert systems in the FuzzyTECH software environment (demo), etc.

It is also provided acquisition by students of basic knowledge in the field of fuzzy modeling, acquisition of abilities and skills of mathematical description of fuzzy logical operations.

# be able:

- systematize information about the field of application of fuzzy systems;
- develop fuzzy models;
- use the composition of binary fuzzy relations;
- develop fuzzy expert systems in the software product FuzzyTECH;
- develop a fuzzy controller control program in management systems Competencies that the student receives as a result of studying the course:
- Ability to develop and apply IST necessary for solving strategic and current tasks.
- The ability to develop mathematical, information and computer models of objects and informatization processes.
- The ability to apply modern models and methods of fuzzy logical deduction based on forms of knowledge
  presentation and ways of organizing the search for solutions; design and develop expert systems.

#### Learning outcomes: upon completion of the course, the student will have skills

- Determine ICT requirements based on business process analysis and stakeholder needs analysis, develop technical tasks.
- Develop models of information processes and systems of various classes, use methods of modeling, formalization, algorithmization and implementation of models using modern computer tools.
- Use modern fuzzy models, methods and tools of artificial intelligence in decision-making systems, apply intelligent algorithms using fuzzy models to solve artificial intelligence problems.
- Present research results, conduct discussions, publish research results.
- Be able to work effectively both individually and as part of a team.
- Be able to evaluate the obtained results and justify the decisions made.
- To perform work qualitatively and achieve the set goal in compliance with the requirements of professional ethics.

#### FORMS AND METHODS OF TEACHING

The course will be taught in the form of lectures (14 hours) and laboratory classes (16 hours), organization of students' independent work (84 hours).

The basic training of students is carried out in lectures and laboratory classes.

During the teaching of the course, the following teaching methods are used: verbal (lecture, explanation); face-to-face (presentation using multimedia presentation material); practical (laboratory works); work with literary sources (independent work of students).