

ODESSA I.I. MECHNYKOV NATIONAL UNIVERSITY
FACULTY OF MATHEMATICS, PHYSICS AND INFORMATION TECHNOLOGIES
DEPARTMENT OF MECHANICS, AUTOMATION AND INFORMATION TECHNOLOGIES

Syllabus of the course "Information processes modeling methods in complex systems"

Amount	Total number: credits – 4; hours – 120; content modules - 3
Semester, year of study	autumn
Days, time, place	according to the class schedule
Teacher(s)	Alla Rachynska, PhD (Physics and Mathematics), Associate Professor Kateryna Palii, lecturer
Contact phone number	063 26 59 888
E-mail	rachinskaya@onu.edu.ua
Workplace	department of mechanics, automation and information technologies
Communication	online consultations: the link to the relevant zoom conference is provided to the applicant of higher education of the I.I. Mechnikov National University after his request (letter) to the e-mail address indicated above in this table

COMMUNICATION

Communication with students will be carried out via: e-mail, zoom-conferences, or face-to-face in the classroom during the implementation of the general off-line mode of conducting classes.

COURSE ABSTRACT

Subject of the study of the course is mathematical modeling of complex systems. Analytical and numerical study. Comparative analysis of the obtained results. Methods of complicating models by taking into account various factors of real processes in complex systems. Construction of dimensionless models. Methods of obtaining admissible model parameters.

Course prerequisites

The course material is based on the previously acquired knowledge, practical skills and skills of the students on topics and areas related to the formulation of the differential equation of the relative motion of a material point for a system performing complex motion.

Additionally, it is advisable to have basic knowledge of numerical methods, computer graphics. The corresponding courses are taught within the educational program of the first (bachelor) level of higher education in specialty 126 "Information systems and technologies".

Post-requisites course

This course is an additional basis for mastering the following disciplines of the educational and professional training program OK08 "Systems of operational analytical data processing" in specialty 126 "Information systems and technologies".

Purpose of the course is formation of students' complex of scientific knowledge on mathematical modeling of complex systems. Essentially important in the theory of mathematical modeling is the constant coordination of all aspects of building a model with the tasks and goals of research. This course focuses on some features of mathematical modeling of mechanical systems and processes that are essential for research.

Course content

Content module 1. Models and modeling. (Topic 1. Concept of modeling. Examples of models. Topic 2. Modeling of systems and processes. Topic 3. Mathematical modeling methodology. Topic 4. Mathematical models and their types.)

Content module 2. Modeling complex movement of a material point. (Topic 1. Motion of a material point in a perfectly smooth tube. Analytical and numerical modeling. Topic 2. Modeling of complex motion of a material point along a rough tube. Topic 3. Modeling of complex motion of a material point in a medium with resistance. Topic 4. Modeling of complex motion of a material point with uneven rotation of the plate.)

Content module 3. Modeling processes and systems in a dimensionless form. (Topic 1. The equation of the complex motion of a material point in a dimensionless form. Topic 2. Modeling the complex motion of a material point in a dimensionless form. Topic 3. Modeling of a flat area of process parameter selection. Topic 4. Modeling of a volumetric area of process parameter selection.)

EXPECTED RESULTS

As a result of the study educational disciplines the student must

know: methodology construction of mathematical models of mechanical processes and systems; how to use programming languages, information resource description languages, specification languages, tools during the design and creation of information systems; how to carry out research work in the field of theoretical informatics and applied mathematics during the development of new information technologies.

be able: process received the results, analyze, interpret and present them, justify the proposed solutions at the modern scientific and technical level; programmatically implement algorithms for solving problems, develop system and application software for information systems and technologies; build mathematical models based on experimental and statistical data; apply the knowledge and skills acquired during training to conduct scientific and applied research, present and publish its results.

Competences, which the student receives as a result of studying the course:

- Ability to abstract thinking, analysis and synthesis.
- Ability to design information systems taking into account the specifics of their purpose, incomplete/insufficient information and conflicting requirements.
- The ability to develop mathematical, information and computer models of objects and informatization processes.
- The ability to solve physical and mathematical problems related to the modeling of natural phenomena or technological processes, using modern computer methods.
- The ability to model the architecture, behavior and processes of functioning of specialized, autonomous and distributed intelligent systems of automated search and analysis of information.

The results training: at the end of the course, the student will have the skills

- Manage ICT development, implementation and operation processes that are complex, unpredictable and require new strategic and team approaches.
- Justify the choice of technical and software solutions, taking into account their interaction and potential impact on solving organizational problems, organize their implementation and use.
- Develop models of information processes and systems of various classes, use methods of modeling, formalization, algorithmization and implementation of models using modern computer tools.
- Develop mathematical models and software and information systems for solving current problems of multimedia information analysis and processing.

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 (90 hours).

The main training of students is carried out in lectures and laboratory classes, but to a large extent it relies on independent study of the material by students during the semester.

During the teaching of the course, the following teaching methods are used: *pfishing* (lecture, explanation); visual (illustration of the material in the form of multimedia presentations); practical (laboratory work); work with literary sources (independent work of students).