Odesa I.I. Mechnikov National University
Faculty of Mathematics, Physics and Information Technologies
Department of Mechanics, Automation and Information Technologies

Course syllabus
"Visualization_of_mechanical_processes"

Amount	4 credits, 120 hours
Semester, year of study	2nd semester, 1st year of master's studies
Days, time, place	
Teacher(s)	Viktor Volkov, Doctor Sciences (Tech.), Professor
Contact phone number	067 486 8584
E-mail	viktor@te.net.ua
Workplace	department of mechanics, automation and information technologies
Consultations	*online consultations:* a 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) at the e-mail address indicated above in this table

COMMUNICATION

Communication with students is 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 discipline

Basic methods and means of visualization of mechanical processes and their application using modern computer technology and object-oriented programming languages for solving current problems of information technology and automatic control.

Course prerequisites

ВБ7 – Special course

Post-requisites of the course

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Aim of the course

The aim is to provide theoretical knowledge of mechanics and practical skills in the application of methods and means of visualizing mechanical processes using modern computer technology and object-oriented programming languages for solving current problems of information technology and automatic control.

The purpose of the lectures is to master the laws of mechanics and general methods of solving mechanics problems, as well as the rules of developing applied mathematical and software for visualization of various mechanical processes.

The purpose of conducting of laboratory works is mastering and in-depth assimilation of techniques for using modern programming languages in the development of calculation algorithms for solving mechanics problems and visualization of correspondent mechanical processes.

Tasks of the discipline

The task of the discipline for students is to acquire theoretical knowledge and practical skills in the development of application software for visualization of mechanical processes.

The process of studying the discipline is aimed at forming:

ability to abstract thinking, analysis and synthesis; ability to evaluate and ensure the quality of performed works in the field of ICT; knowledge about the rules for setting a research task, approaches to choosing a goal, analyzing a problem and methods of solving it, rules for presenting results, conducting a discussion and publishing scientific materials;

ability to develop mathematical, information and computer models of objects and informatization processes; ability to mathematically model digital data and use effective algorithms for analysis and transformation of multimedia data in modern information systems.

Expected results

As a result of studying the academic discipline, the student of higher education should **know:**

- the main stages of solving a modern physico-mathematical problem using examples of solving mechanical problems;
- mathematical statements of the main problems of mechanics and their components;
- basic models, methods, algorithms and their software implementation, when solving a specific or general problem of mechanics;
- the main elements of modern programming used in the visualization of mechanical processes;
- numerical methods of solving mathematical problems;
- numerical methods of solving systems of nonlinear equations;
- methods of creating computer interfaces for research programs;
- methods of composition of various software modules within the framework of a single application.

be able:

- develop physical and mathematical models of mechanical processes and physical objects;
- to solve problems of mechanics and physics analytically or using numerical methods;
- develop information models of objects;
- apply modern programming languages and software component development environments to solving specific or general physical and mathematical problems;
- develop and apply modern methods of visualization of mechanical processes;
- use software components and forms for designing software implementations, use media for storing calculation results;
- prepare reports on completed tasks, describe software components, etc.;
- perform calculations according to developed programs.

- **COURSE DESCRIPTION**

Forms and methods of education

The course will be taught in the form of lectures (12 hours) and laboratory classes (12 hours), organization of students' independent work (96 hours).

Teaching methods used when teaching the discipline:

Verbal : lecture, consultation.

Visual : illustration of the material in the form of multimedia presentations.

Practical : solving computational problems; laboratory works; performance of individual control tasks.

Content of the academic discipline

Content of the module 1. " General mechanical problems and their solutions"

Topic 1. "Introduction. Mechanical processes and their modeling"
Topic 2. "Computer modeling of the movement of a material point in a uniform gravity field"
Topic 3. "Computer modeling of the movement of a discrete system of material points"

Content of the module 2. " Visualization of mechanical vibrations"

Topic 4. "General concepts of the theory of oscillations"
Topic 5. "Computer modeling of forced vibrations of a material point"
Topic 6. "Waves as a process of propagation of oscillations"

List of recommended literature

1. Andrunyk V.A., Vysotska V.A., Pasichnyk V.V., Chirun L.B., Chirun L.V. Numerical methods in computer sciences: a study guide. Lviv: "New World - 2000", 2020. 470 p.
2. Weisfeld N. D. Equations of mathematical physics: teaching method. manual for students special "Applied mathematics" / N. D. Weisfeld, V. V. Reut. – Odesa: Odesk. National University named after I. I. Mechnikova, 2018. 194 p.
3. Makhney O.V. Mathematical modeling. Ivano-Frankivsk: V.P. Suprun, 2015. – 372 p.
4. Pavlovsky M.A. Theoretical mechanics. K.: Technika, 2002. 510 p.
5. Theoretical mechanics / V.M. Bulgakov, V.V. Yaremenko, O.M. Chernysh, M.G. Berezovy - K.: Center for Educational Literature, 2019. 705 p.

EVALUATION

Methods of current \ periodic control : evaluation of the performance of laboratory work and control tasks.

Final control : **Exam**. The final assignment is a written colloquium based on the theoretical material of all substantive modules.

Distribution of points:

Current and periodic control							Final control (exam)	Total points
Content module 1			Content module 2			Individual independent task		
T1	**T2**	**T3**	**T4**	**T5**	**T6**			
10	**10**	**10**	**10**	**10**	**10**	**-**	**40**	**100**

Additional (bonus) points are given if the student uses original analytical methods or software tools when performing laboratory work or control tasks, or high-quality design of calculation results and a general report.

Independent work of students

The student's independent work consists in completing a set number of individual control tasks on the specified topics, mastering planned and additional theoretical material, which is provided in the form of an electronic lecture summary.

An academic week is given for the completion and preparation of a report on laboratory work or a control task. Work submitted late will be graded with fewer possible points .

The format of the report and a sample of the performance of all types of work are provided to students in electronic form (stored together with other methodical materials) on the appropriate resource.

It is allowed to correct the calculation results without losing points.

COURSE POLICY ("rules of the game")

Deadlines and Rescheduling Policy:

The student of higher education has the opportunity to independently master this course with the help of methodical materials that are provided. Attendance at classes is not mandatory, but is desirable.

The academic integrity policy provides for :

Independent performance of educational tasks, tasks of current and final control of learning results.