



## Syllabus Course Program

### Physics

**Specialty**

162 – Pharmaceutical biotechnology

**Institute**

Institute of Computer Modeling, Applied Physics and Mathematics

**Educational program**

Pharmaceutical biotechnology

**Department**

Physics (168)

**Level of education**

Bachelor's level

**Course type**

General, Mandatory

**Semester**

1, 2

**Language of instruction**

English, Ukrainian

### Lecturers and course developers

**Olena Lyubchenko**

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Candidate of physical and mathematical sciences, Ph.D., professor, Head of Department of Physics, NTU "KhPI".

Author of more than 90 scientific and educational publications.

Lecturer in the courses "Physics"

[More about the lecturer on the department's website](#)

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Author of more than 100 scientific and educational publications.

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[Детальніше про викладача на сайті кафедри](#)

### General information

#### Summary

The course of physics acquaints with the fundamental concepts, laws and theories of classical and modern physics, the basic methods of solving physical problems, and the features of physical processes. This will ensure the effective mastery of special disciplines and further possibility of using physical principles in professional activity. The course covers all sections of physics as a fundamental discipline that forms a holistic picture of the modern world. During the study of basic laws and phenomena, students acquire skills of learning the laws of physics in practice, summarize and analyze the results of physical experiments to apply in the field of pharmaceutical biotechnology.

#### Course objectives and goals

The aim of the course is to provide future bioengineers with a base knowledge of physics; to form students' skill of understanding the physical content of problems; to develop students' ability to practically apply fundamental knowledge of physics in the field of pharmaceutical biotechnology.

## Format of classes

Lectures, laboratory classes, self-study, consultations. Final assessment is an exam.

## Competencies

GC06.

GC10.

## Learning outcomes

LA01.

LA12.

LA15.

## Student workload

The total volume of the course is 240 hours (8 ECTS credits): lectures - 8 hours, laboratory classes - 8 hours, self-study - 224 hours.

## Course prerequisites

To successfully learn the course, you must have knowledge and practical skills from the courses "Physics", "Algebra and the beginnings of analysis" in the scope provided by the programs of general secondary schools

## Features of the course, teaching and learning methods, and technologies

Lectures are conducted interactively using multimedia technologies. Laboratory classes use problem-based learning, teamwork, case method, feedback method from students.

## Program of the course

### Topics of the lectures

First semester

#### Topic 1. Physical basis of mechanics. Fundamentals of Molecular Physics and Thermodynamics

Elements of particle kinematics. Dynamics of material point. A rigid body in mechanics and the laws of its motion. Work and energy.

Fundamentals of molecular kinetic theory of gases. Fundamentals of thermodynamics

#### Topic 2. Electricity and Magnetism

Electrostatics in vacuum. Conductors and dielectrics in electrostatic field. Direct electric current.

Magnetostatics in vacuum. The magnetic field in a substance. Electromagnetic induction. Basics of Maxwell's theory for electromagnetic field

Second semester

#### Topic 3. Mechanical oscillations and waves. Optics

Harmonic oscillations. Decaying and forced oscillations.

Geometric optics. Interference and diffraction of light. Electromagnetic waves in matter

#### Topic 4. Basic concepts of quantum physics. Physics of Atom and Atomic Nucleus

Elements of quantum optics. Substantiation of basic ideas of quantum theory. Quantum mechanics and corpuscular-wave dualism of matter. Quantum state. Schrodinger equation.

Atom. Nucleus. The concept of particle physics and the modern physical picture of the world

### Topics of the workshops

Workshops works are not provided within the discipline

## Topics of the laboratory classes

First semester:

Topic 1. Laboratory work on Mechanics

Topic 2. Laboratory work on Electricity

Second semester

Topic 3. Laboratory work on Mechanical oscillations

Topic 4. Laboratory work on Optics

## Self-study

The course requirements involve fulfilment of individual calculation and graphic assignment. Results must be represented as a written report. Students are also recommended educational material (lecture notes; problem solving guide) for self-study.

## Course materials and recommended reading

Compulsory materials

1. Lyubchenko O. A. Mechanics : [study guide] = Механіка : навч.-метод. посібник / О. А. Lyubchenko. – Kharkiv : NTU "KhPI", 2016. – 324 p. – Engl. lang. URI: <https://repository.kpi.kharkov.ua/handle/KhPI-Press/26411>
2. Lyubchenko O. A. Mechanics. Oscillations and waves : Конспект лекцій по курсу "Фізика" на англ. яз. / Е. А. Любченко, А. Ю. Гребенник ; Нац. техн. ун-т "Харьк. политехн. ин-т". - Х. : НТУ "ХПИ", 2006. - 51 p. URL: <http://web.kpi.kharkov.ua/tef/educational-material-in-english-ua/>
3. Lyubchenko O. A. Electricity and magnetism : Конспект лекцій по курсу "Фізика" на англ. яз.; - Х. : НТУ "ХПИ", 2006. - 71 с. URL: <http://web.kpi.kharkov.ua/tef/educational-material-in-english-ua/>
4. Lyubchenko O. A. Optics. Atomic and Nuclear Physics: Конспект лекцій по курсу "Фізика" на англ. яз. НТУ "ХПИ", 2006. - 122 с.
5. Lyubchenko O. A. Magnetism : [problem solving guide – Kharkiv : NTU "KhPI", 2012. - 39 p. [http://web.kpi.kharkov.ua/tef/wp-content/uploads/sites/114/2020/03/Magnetism\\_problems.pdf](http://web.kpi.kharkov.ua/tef/wp-content/uploads/sites/114/2020/03/Magnetism_problems.pdf)
6. Lyubchenko O. A. Electricity : [problem solving guide – Kharkiv : NTU "KhPI", 2015. - 42 p. [http://web.kpi.kharkov.ua/tef/wp-content/uploads/sites/114/2020/03/Magnetism\\_problems.pdf](http://web.kpi.kharkov.ua/tef/wp-content/uploads/sites/114/2020/03/Magnetism_problems.pdf)

Additional materials

1. D.C.Giancoli. Physics for scientists and engineers with modern Physics. 4th ed., Pearson Education, Inc., USA, 2009.
2. N.J.Giordano. College Physics. Reasoning and Relationships. 2 ed., V1 and 2, Brooks/Cole, Cengage Learning, USA, 2010
3. Physics. Principles and Problems. Glencoe Science Program. Interactive Students Edition., 2005 URL: <http://physicspp.com>
4. J. Walker. Fundamentals of physics /J.Walker, D. Halliday, R. Resnick - 10th extended ed., USA, 2014  
R.A.Serway, C.Vuille, J.S.Faughn. College Physics. Brooks/Cole, Cengage Learning, USA, 2009

## Assessment and grading

### Criteria for assessment of student performance, and the final score structure

100% of the final grade consists of assessment results in the form of an exam (50%) and current assessment (50%).

Exam: written assignment (2 theory questions + problem solving) and oral presentation.

Current assessment: oral answers during laboratory classes (10%), test (5%) homework (35%).

### Grading scale

Total points	National	ECTS
90-100	Excellent	A
82-89	Good	B
75-81	Good	C
64-74	Satisfactory	D
60-63	Satisfactory	E
35-59	Unsatisfactory (requires additional learning)	FX
1-34	Unsatisfactory (requires repetition of the course)	F

## Norms of academic integrity and course policy

The student must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management.

Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU "KhPI" are available on the website: <http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/>

## Approval

Approved by

Date, signature  
28.08.2023

Head of the department  
Olena LYUBCHENKO

Date, signature  
28.08.2023

Guarantor of the educational program  
Oleksandra VARANKIN