



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**

olena.lyubchenko@khpi.edu.ua

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](#)

**Iryna Halushchak**

Iryna.Halushchak@khpi.edu.ua

Candidate of technical sciences, associate professor of Physics, NTU "KhPI".

Author of more than 100 scientific and educational publications.

Lecturer in the courses "Physics"

[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 - 64 hours, laboratory classes - 32 hours, self-study - 148 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. Introduction to the course

Topic 2. Elements of particle kinematics

Topic 3. Dynamics of Particles

Topic 4. Dynamics of a rigid body

Topic 5. Conservation laws in classical mechanics

Topic 6. Fundamentals of molecular physics and thermodynamics

Topic 7. Transference phenomena

Topic 8. Basics of thermodynamics

Topic 9. Isoprocesses. Thermal machines

Topic 10. Phase equilibrium and phase transformations m

Topic 11. Real gases

Topic 12. Electrostatics in vacuum

Topic 13. Conductors and dielectrics in an electrostatic field

Topic 14. Magnetostatics in vacuum

Topic 15. Magnetic field in matter

Topic 16. Electromagnetic induction

Second semester

Topic 17. Harmonic oscillator

Topic 18. Addition of harmonic oscillations

Topic 19. Damping, forced, parametric and nonlinear oscillations

Topic 20. Wave processes

Topic 21. Electromagnetic waves

- Topic 22. Interference of light
- Topic 23. Diffraction of light
- Topic 24. Propagation of light in matter
- Topic 25. Basics of relativistic mechanics
- Topic 26. Elements of quantum optics
- Topic 27. Basics of non-relativistic quantum mechanics
- Topic 28. The problem of the state of microparticles: classical and quantum
- Topic 29. Atom
- Topic 30. Crystal
- Topic 31. Nucleus
- Topic 32. 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 Mechanics
- Topic 3. Laboratory work on Molecular Physics
- Topic 4. Laboratory Work on the Basics of Thermodynamics
- Topic 5. Final lesson on the basics of molecular physics and thermodynamics
- Topic 6. Laboratory Work on Electricity
- Topic 7. Laboratory work on magnetism
- Topic 8. Final lesson on the topic "Electromagnetism"

Second semester

- Topic 9. Laboratory Work on Harmonic Oscillations
- Topic 10. Laboratory work on wave processes
- Topic 11. Final lesson on the topic "Oscillations and waves"
- Topic 12. Laboratory Work on Optics
- Topic 13. Final lesson on optics
- Topic 14. Laboratory work on quantum mechanics
- Topic 15. Laboratory Work on Electrical Conductivity of Matter
- Topic 16. Final lesson

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
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

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 (40%) and current assessment (60%).

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

Current assessment: oral answers during laboratory classes (10%), test (30%) individual calculation and graphic assignment (15%), homework (5%).

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

